NSWCDD/TR-92/47

INFORMATION STRATEGY PLAN

BY W. R. BURRELL C. B. WILSON
ENGINEERING & INFORMATION SYSTEMS DEPARTMENT

JANUARY 1992

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
Dahlgren, Virginia 22448-5000

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EXECUTIVE SUMMARY

Business enterprises must learn to survive in a rapidly changing and highly competitive environment. The Naval Surface Warfare Center, Dahlgren Division (NSWCDD) is no different in this regard than any commercial enterprise. Department of Defense (DoD) consolidation and realignment initiatives will likely introduce more change to NSWCDD than at any time in recent history. DoD will probably face large funding cuts as a result of changes in Europe and Asia. NSWCDD must be able to manage that change and still meet the demand for high-quality products and services at competitive cost. NSWCDD is essentially a knowledge-based industry, and therefore depends upon a flexible and responsive information infrastructure to accomplish its mission. The more change that occurs in our environment, the more flexible that infrastructure must be.

The first step in effecting a flexible infrastructure was to identify where change might be beneficial by analyzing what information and functions are needed and how they should relate for NSWCDD to operate as a Defense Business Operating Fund (DBOF)-funded R&D organization. This analysis needed to be performed without regard to current processes or organizational structures. Information Strategy Planning (ISP) is the top-level identification of how and what we could do, what types of information are required, and how it makes sense to group them for optimal sharing of information and minimal cross-functionality.

The purpose of this document is to report on the findings and recommendations arising from the ISP task. ISP provides the link between the business strategy planning and the development of information systems and architectures. ISP is most effective when the whole enterprise is included in the analysis. The NSWCDD ISP project included NSWCDD in its entirety and did not limit its analysis to business functions of the support organizations, but also included functions that relate to the "business" of accomplishing the technical mission of NSWCDD. It identifies strategies for satisfying the complete range of information needs; i.e., not just business systems but also information needed in the generation of NSWCDD products and services. It provides a basis for delivering systems that are relevant to NSWCDD and which are targeted at supporting the principle business directions.

NSWCDD lies in a chain of command which is also pursuing the streamlining and enhancing of its business processes. The DoD, DoN, and NAVSEA Information Resource Management (IRM) strategies will affect the NSWCDD pursuit of its IRM strategies, as laid out in this document. Each of our parent organizations are moving ahead in efforts to change functional processes and reexamine the IRM role within our communities. The ISP incorporates the DoD, Department of Navy (DoN), and Naval Sea Systems Command (NAVSEA) visions for improved business processing and is consistent with the direction being taken by these organizations at this time. The ISP and follow-on work of analyzing our business areas will position us to respond correctly and rapidly to the work going on above us in the chain of command.

The four principal products of ISP are (1) the Information Architecture, (2) the Business Systems Architecture, (3) Technical Architecture, and (4) the strategy for information systems development. The architectures constitute a model of the business. They can be used to suggest and evaluate a wide range of possible change, including organizational structure change, process improvement, and change of business rules.

The Information Architecture consists of a data model and a function model that represent the categories of data that are important to the enterprise and the high-level functions that use those data. Analyzing the interactions; i.e., create, read, update, and delete, that exist between functions and data yields a Business Systems Architecture. The Business Systems Architecture is comprised of logical data stores and business systems. At the planning stage, the Technical Architecture consists of a model of the types of hardware, software, and communications technology that will be required to support the systems architecture.

We identified 63 processes from a functional decomposition of NSWCDD and 48 data entity types. By analyzing the interactions between processes, between data entity types and between processes and data entity types, we re-grouped the processes and data entity types. The processes are grouped into 25 business systems (Figure 4-6), which are further grouped into 10 business areas (Figure 4-8). The data entity types are grouped into thirty-three data stores (Figure 4-5), and then the data stores are associated with the business area that creates their data. The future work involves analyzing the individual business areas and then developing the required systems and databases to carry out the needed functionality. The systems developed to support any business area need not be automated, but may only be an improved manual or semi-automated system.

The ISP has specified a very large, complex and highly interrelated model to be used for information technology system development. The model reflects the complexity and flexibility under which NSWCDD operates. The information strategy should be driven by business needs. To meet the business needs will require that strategies also be pursued to assess and implement a technologically effective infrastructure. The largest business drivers are:

1. need to lower NSWCDD operating costs
2. large administrative burden on line management and technical staff
3. non-compliant financial management system
4. DoD Corporate Information Management (CIM) mandated systems looming
5. multiple sites needing to share information
6. lack of coordinated data
7. less functionality in office automation than desirable

These drivers combine in different ways to direct which business areas should be analyzed first and which information organization strategies are required immediately. The strategies are fairly risky and will tax the abilities of the Systems Division to proceed on such a broad front. The political situation and environment of NSWCDD and the NSWC Information Command and Control System (NICCS) Program, however, drives us to this course of action. There is a risk of slipped deadlines. If not too delayed, the damage may not be too bad as the CIM and NAVSEA efforts may also not meet their schedules. CIM is behind its objectives at this time because they

were also pursuing a very aggressive course of action. There is a large risk of funding being cut to the program. The result of deep cuts would be the inability to carry out these directions and the consequential inability of NSWCDD to be relieved of the severe productivity deterrents represented by the drivers.

We will follow a focused effort in the Business System area. A focused effort is needed because of the extreme pressure of drivers (1), (2), (3) and (4). The focused effort will include the Financial Management area and that part of the Planning & Review area that involves financial data. This is a risky direction to take but is necessary because of time constraints. NSWCDD must be able to define its information and process requirements in this area before CIM furnishes financial systems to do the financial transaction processing. Without the NSWCDD requirements, we would be unable to effectively respond to and implement those systems. If CIM does not produce a financial system, we must still pursue this direction because of the non-compliant status of the current financial management system.

We will move out of the normal Information Engineering methodology and pursue the development of the Corporate Database (CDB) in parallel with the focused effort. The CDB is the logical database containing all of the business data of NSWCDD. Normally, the analysis of the Business Areas defines the data needs. We will attempt to build preliminary databases comprised of data elements already found in some existing systems. We are taking this tack because of drivers (1), (2), (4) and (6). This effort will also focus on financial data initially. The CDB effort will be involved in more than the data requirements of the Financial Management Business Area Analysis. As will be seen by the diagrams and charts in Chapter 4, every business area updates or reads data from many other business areas. In particular, data stores from the Organization Management and Product Development business areas will need to have skeleton databases developed. The principle data requirements for Organization Management were automated several years ago. The Center Human Resource Information System (CHRIS) was developed for the Human Resource Department and is based on relational database technology. It will form the basis for the supply of personnel and organizational information needed for the Financial Management business area. Data extract programs will need to be developed between CHRIS and the CDB. Of course, eventually, CHRIS databases will become a part of the CDB. Skeleton data bases for the other data needs will be defined and populated, pending proper definition at a later time. Techniques will also have to be developed for the population and low-level maintenance of these skeleton databases.

Moving into a controlled information environment requires the establishment of a data administration function. This is the principle infrastructure media for effecting the proper environment for information management and the coordinated development of information systems. In particular, drivers (1), (2), (4), (5), and (6) strongly support this strategy. Data administration deals with the management and control of data as an enterprise asset. It includes strategic information planning, data modeling, logical database design, and the establishment of standards, policies, and procedures for the care and feeding of data; e.g., ownership, security, privacy, quality, and integrity. Data administration leads to improved NSWCDD profitability. We will establish a Data Administration (DA) function at NSWCDD. The functions described within the scope of DA at NSWCDD will include: DA representation, policies, guidelines and standards; DA partnerships; data planning; the data repository and configuration management; compliance with DA policies and standards; and DA measurement of program

effectiveness. These functions are consistent with the DoD and DoN DA guidelines, directives, and implementation procedures.

The establishment of the DA function will not solve the information problems of NSWCDD by itself. DA is a piece of the bigger infrastructure and services needed to manage information at NSWCDD. The proper management and use of information at NSWCDD would produce the biggest benefit to NSWCDD -- more than financial management. NSWCDD as an R&D center is in the knowledge business. We take information and transform it into services or products. Being able to access and use information effectively is the key, therefore, not only to the proper functioning of our business processes but also to our producing products and services. Lack of automation support for collaboration inhibits our ability to make teams of people across sites. Lack of automation support for the survey of outside information on developments in our areas of business increase the time it takes our personnel to stay abreast of their technical fields and increase the risk of missing a vital piece of information that might make a breakthrough possible. Lack of coordinated data to respond to outside fire drills drains the time of our line managers from technical leadership efforts. The list is quite long. Defining good information management is critical to the solutions for drivers (1), (2), (5), (6), and (7).

The analysis of the Information Management (IM) business area is the most difficult technically of all of the business areas and is tightly interwoven with all other work stemming from the ISP. The IM business area will be difficult to perform because its analysis does not completely follow the normal Information Engineering methods because its goal is more than the definition and development of systems. Part of the IM work is the identification of tools and technologies to be employed in the care and feeding of information identified in other business areas. However, the identification of these tools and technologies will help determine the direction pursued in the other efforts -- even to the extent of suggesting information that could be created. We are left with a circular problem and a technology that moves extremely rapidly. The IM business area enables the other business areas to proceed in a coordinated and effective manner. The outcome of this effort will define the infrastructure required for the life cycle of all the systems to be developed and also will define services and functions needed to handle the various types of information used at NSWCDD -- regardless of the form. This latter outcome provides the rationale for making decisions about the technical architecture and permits the evaluation of new technologies' applicability to NSWCDD problems.

NSWCDD is in the process of establishing a Total Quality Management/Leadership (TQM) environment. This change in organizational and mangerial philosophy will have a major impact on the design and implementation of information systems. Every other business change that has occurred in the past has been designed to move complexity out of the work environment and to move information handling up the organization ladder. Now, we are giving decision making responsibility to the lowest possible level. To be able to make decisions, the employees of NSWCDD will need information. Three things will affect the information processing scenario. First, the type of information will change at different levels from what it has been in the past. In particular, for TQM to work, each employee needs to know the vision, direction, and evaluation criteria that combine to tell him or her what constitutes success for the organization. Without this information, the employee can not consistently make proper decisions; i.e., decisions that will move the organization on towards improved productivity and client satisfaction. Traditionally such information has been given selectively to managers at different

levels. Now the field is wide open. Second, since the field is wide open and since decisions will be being made by more people, the sources of information will be much more widely dispersed. At NSWCDD there is great physical distance between major locations and physical distances between people who need to share information at a particular site. The availability requirements and timeliness requirements still remain, and need to satisfy many more people who are geographically dispersed. These needs should affect technical design decisions; i.e., move away from large central databases because of potential reliability and performance problems. Third, TQM and Information Engineering (IE) have a great overlap in purpose and process. NSWCDD will need to mesh its efforts in these two areas.

The strategy above has been formulated for the first steps. When these efforts are completed, the next steps will be determined. The volatility of the environment makes setting direction for the longer course ludicrous. The ordering of these and future steps should be based on the most important needs of NSWCDD and will be reviewed as events cause NSWCDD to re-order its priorities. We will continue to pursue the course that makes best sense for NSWCDD while adjusting to external drivers.

FOREWORD

The Information Strategy Plan contained in this report was produced by the Systems Division of the Engineering and Information Systems Department supported by personnel from many of the NSWCDD technical and support departments.

The main body of the report was written by W.R. Burrell and C.B. Wilson of the Systems Division with contributions from W.R. Cushing, D.E. Tabler and D.L. Becker. The Information Engineering architecture details were modeled by a core team of Systems Division personnel using information supplied by a reference team of NSWCDD employees. The effort used a Knowledgeware, Inc. Information Engineering Workbench (IEW) CASE tool on a 25 MHz 80386-based personal computer to assist in the modeling. The James Martin Associates Information Engineering methodology was followed.

The E50 core team included: W.R. Burrell, M.L. Hye-Knudsen, M.A. Reese and K.L. Truslow. The NSWCDD reference team included: FCCM D.S. Reedal (C4); C.L. Berkey (D2); R.D. Wiseman and R.M. Pollock (E); W. Innis (G); L.C. Loeffler (K); H.O. Williams, B.S. Goldman and L.W. Dabbs (M); W.J. Ferreira (P); K.F. Caudle and C.W. Larson (R); J.L. Schmidt (S); R.C. Otte (U); and E.N. Resio (W). Advisors used included: C.L. Burleson and C.B. Wilson (E50); D.C. Gardiner (E04); James Martin Associates; Knowledgeware, Inc.; and the Fleet Material Support Office (FMSO).

If you have any questions or comments on the Information Strategy Plan outlined in this report or the process used, please contact the Systems Division on (703) 663-1827. The detailed definitions of functions and data entities are not included in this report but are available.

Approved by:

R.T. RYLAND, JR., Head
Engineering and Information
Systems Department

ABSTRACT

An enterprise-wide Information Strategy Plan (ISP) and model was developed for a 5000 person, Navy R&D center, spanning four geographically dispersed sites. The ISP included all of NSWCDD as it was constituted at that time before the consolidation; i.e., the ISP does not include the Coastal Systems Station. The ISP was not restricted to the support areas but included the technical mission of the center. The ISP provides a basis for delivering systems that are relevant to the enterprise and that are targeted at supporting the principle business directions. The work analyzed the total business goals for NSWCDD with respect to how information technology does or could enhance its abilities to meet its goals. Using teams of people representing many viewpoints and levels within in the enterprise, models were developed showing what information and functions NSWCDD needs to perform its business. A data model consisting of 48 entity types and a function model consisting of 63 processes were developed. These two models were combined using affinity analysis to generate 10 groups of entity-types and processes, called business areas. The groupings are without regard to current organizational structure. A technical architecture was developed to describe approaches to be used to implement the business areas in the future. The report also describes the methodology used to generate the ISP. The approach was based on a form of Information Engineering, assisted by automated Computer-Aided Software Engineering (CASE) tools.

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CHAPTER 1

INTRODUCTION

Business enterprises must learn to survive in a rapidly changing and highly competitive environment. The Dahlgren Division of the Naval Surface Warfare Center (NSWCDD) is no different in this regard than any commercial enterprise. Dod consolidation and realignment initiatives will likely introduce more change to NSWCDD than at any time in recent history. NSWCDD must be able to manage that change and still meet the demand for high-quality products and services at competitive cost. NSWCDD is essentially a knowledge-based industry, and therefore depends upon a flexible and responsive information infrastructure to accomplish its mission. The more change that occurs in our environment, the more flexible that infrastructure must be.

The NSWC Information Command and Control System (NICCS) was established to satisfy identified, but unsatisfied, operational needs at NSWCDD. In particular, the goal of NICCS is to expedite NSWCDD business operations and enable NSWCDD to be more responsive and competitive as an R&D center. For NICCS to be a successful program, it was determined that it should enable NSWCDD to change the way it operates by identifying where such changes could occur and then providing automation support, when required, to implement those changes. The first step in effecting this strategy was to identify where change might be beneficial by analyzing what information and functions are needed and how they should relate for NSWCDD to operate as a DBOF-funded R&D organization. This analysis needed to be performed without regard to current processes or organizational structures. The ISP is the top-level identification of how and what we could do, what types of information are required, and how it makes sense to group them for optimal sharing of information and minimal cross-functionality. From this beginning, NSWCDD through the NICCS program can continue the analysis of each grouping to define better processes and the proper organizational structures to perform the re-defined processes.

The purpose of this document is to report on the findings and recommendations arising from the ISP task. ISP provides the link between the business strategy planning and the development of information systems and architectures. It identifies strategies for satisfying the complete range of information needs for NSWCDD; i.e., not just business systems but also information needed in the generation of NSWCDD products and services. It provides a basis for delivering systems that are relevant to NSWCDD and targeted at supporting the principle business directions.

NSWCDD lies in a chain of command which is also pursuing the streamlining and enhancing of its business processes. The DoD, DoN, and NAVSEA Information Resource Management (IRM) strategies will affect the NSWCDD pursuit of its IRM strategies, as laid out in this document. Each of our parent organizations are moving ahead in efforts to change functional processes and reexamine the IRM role within our communities. The ISP incorporates the DoD, DoN, and NAVSEA visions for improved business processing and is consistent with the

direction being taken by these organizations at this time. The ISP and follow-on work of analyzing our business areas will position us to respond correctly and rapidly to the work going on above us in the chain of command.

ISP is the initial stage of an analysis process (known as Information Engineering). The process strives to ensure that an enterprise's information infrastructure supports the present business needs and is flexible enough to meet future needs as they arise. By analyzing the enterprise as a system in its own right, a baseline of requirements can be established and used as a mechanism for managing change.

Perhaps an analogy will bring this idea into focus. Developing a complex product requires detailed engineering specifications to be produced. Buildings, airplanes, ships, missiles, all have to be specified precisely enough to guarantee that the customer's requirements will be met and that the level of risk associated with producing the product will be acceptable. These specifications are also used to manage changes to these products once they have been developed. No responsible electrician would install a new power outlet without inspecting the building wiring diagram first. No responsible engineer would redesign a component of a weapon system without assessing the impact of that change on the total system.

ISP is the first step toward establishing this specification baseline for NSWCDD's information systems and for NSWCDD itself. The following chapters of this document will address the components of the specification baseline that resulted from analysis of NSWCDD from the perspectives of its information environment, its business systems environment, and its information technology environment. We will discuss these environments in terms of their current state and the state to which they should evolve to better support the business of NSWCDD.

Fundamental to the concept of providing a flexible information infrastructure is the recognition that data is the most stable component of any business. To put this in perspective, consider Figure 1-1, which compares the relative frequency of change that can be expected for data, functions, processes, and procedures.

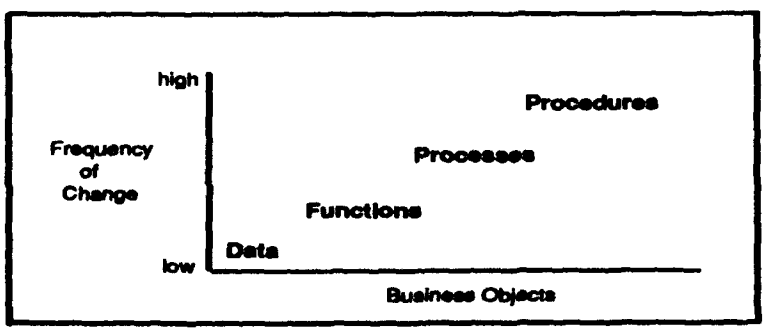


Figure 1-1. Relative Frequency of Change of Business Objects

Business processes and procedures are manifestations of the rules that govern operation of the business. These rules, in turn, are based on interpretations of current policy as dictated from within the organization or from some external authority. Because of the inherent likelihood that business rules will change over time, information systems designed to automate processes and procedures are naturally subject to high rates of change and therefore require a great deal of maintenance over their life cycle. On the other hand, systems whose design is based on the business's data requirements are more flexible, are changed less frequently, and need less maintenance over time. To evolve to this kind of environment, data must be recognized as a resource of the enterprise. Data must be defined in terms of its role in the business and must be independent of the perspective of any particular application. ISP recognizes data as an important resource of the enterprise and lays the foundation for the effective management of that resource.

Automation of processes and procedures codifies the business rules into the information infrastructure. When policies change, in response to changes in the environment, the rules change accordingly. The application programs that implement those rules have to be modified. Processes and procedures will have to be automated -- after all, that is what automation support is about -- but the processes should not drive the design of information systems.

Another reason for the data emphasis at NSWCDD is the use of mandated systems. Having systems mandated for use by DoD or DoN or NAVSEA in effect makes the process and function side of the information systems more volatile. By creating a corporate database environment, the data required for NSWCDD is available regardless of who or what processes the data; i.e., the data is independent of either the local or mandated application. This statement represents a paradigm shift from an applications environment to a data environment. This shift is a major change in the way applications are developed and linked together. Interfaces are developed between the systems, mandated or local, and the stable corporate database. All NSWCDD systems will be developed using the corporate database and need not be affected by changes to mandated systems or introduction of new mandated systems.

1.1 Information Engineering Overview

IE is a data driven methodology. Frequently represented as a pyramid, IE consists of four major stages: Planning, Analysis, Design, and Construction.

The initial stage, ISP, has three main objectives:

a. an understanding of the information requirements of the enterprise
b. a view of the systems necessary to provide the needed information
c. a view of the technologies that may be utilized to implement the needed systems.

These objectives become manifest in the three principal products of ISP: the **Information Architecture**, the **Business Systems Architecture**, and the **Technical Architecture**.

The Information Architecture consists of a data model and a function model that represent the categories of data that are important to the enterprise and the high-level functions that use

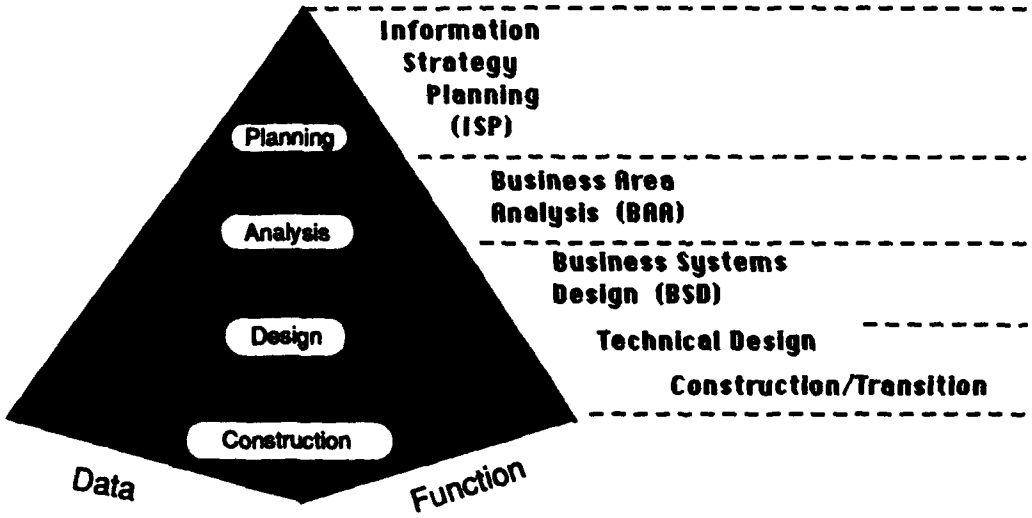


Figure 1-2. The Information Engineering Methodology

those data. Analyzing the interactions; i.e., create, read, update and delete, that exist between functions and data yields a Business Systems Architecture. The Business Systems Architecture is comprised of logical data stores and business systems. At the planning stage, the Technical Architecture consists of a model of the types of hardware, software, and communications technology that will be required to support the systems architecture.

IE also serves as an important mechanism for re-engineering the business itself by virtue of the architectures it produces. The architectures constitute a *model* of the business. They can be used to suggest and evaluate a wide range of possible change, including organizational structure change, process improvement, and change of business rules.

1.2 NSWCDD Information Strategy Planning Project

1.2.1 Project Scope

ISP is most effective when the whole enterprise is included in the analysis. The NSWCDD ISP project included NSWCDD in its entirety and did not limit its analysis to business functions of the support organizations, but also included functions that relate to the "business" of accomplishing the technical mission of NSWCDD.

1.2.2 Project Staffing

Three teams participated in the ISP project. A Reference Team was responsible for identifying high level functional and information requirements of NSWCDD. A Core Team was responsible for facilitating requirements definition workshops, modeling and analyzing Reference Team inputs using CASE (Computer Aided Software Engineering) technology, and synthesizing the three architectures. An Advisory Team was also utilized in a quality assurance role. The Reference Team consists of 14 senior personnel who possess broad functional expertise of Center operations. The Core Team came from the Systems Division personnel. The Advisory Team consisted of CASE tool consultants from KnowledgeWare, Inc., and IE consultants from James Martin Associates and from the Fleet Material Support Office (FMSO), Mechanicsburg, Pennsylvania. Figure 1-3 gives the team staffing details.

1.2.3 Approach

Modeling is universally accepted by scientists and engineers as an analysis technique to understand systems as they are and as they ought to be.[1] Modeling is fundamental to the IE methodology and provides the engineering rigor necessary to design sophisticated, integrated information systems. The overall objective of the ISP project was to develop a model of NSWCDD in terms of the activities it performs and the information it holds important.

The Reference Team, as experts on the business of NSWCDD, provided three primary inputs to the modeling process:

a. major functions performed by NSWCDD
b. major categories of information of interest to NSWCDD
c. rules that govern how business is conducted at NSWCDD

This information was identified within the forum of short (2 or 3 day) workshops facilitated by the Core Team. During the workshops, the Reference Team constructed data models and function models . Between workshops, the Core Team analyzed the models in detail, modified them where necessary to ensure consistency in level of detail, and documented the results for review by the Reference and Advisory Teams.

	Participants	Team Roles
Core Team	Rod Burrell, E51 Tina Reese, E51 Ken Truslow, E54 Melba Hye-Knudsen, E51	o CASE Tool modeling o detailed analysis o product preparation and distribution o workshop facilitation
Reference Team	FCCM Dan Reedal, C4 Chuck Berkey, D2 Bud Wiseman, E Ray Pollock, E Willard Innis, G Linda Loeffler, K Harvey Williams, M Bev Goldman, M Larry Dabbs, M Bill Ferreira, P Ken Caudle, R Carl Larsen, R Judy Schmidt, S Bob Otte, U Ed Reiso, W	o data and function model development o identification of business rules o product validation
Advisory Team	Fleet Material Support Office James Martin Associates Knowledgeware, Inc. Carol Wilson, E50 Carol Burleson, E54	o methodology consultation o CASE tool consultation o quality control

Figure 1-3. ISP Team Membership

1.2.4 CASE Tool

Release 5.01 of the Information Engineering Workbench (IEW), a product of KnowledgeWare, Inc., was used to support the ISP project. The platform was a 25 MHz 80386-based personal computer, with 8 Mbytes of RAM, and running DOS 3.3.

CHAPTER 2

BUSINESS STRATEGY

The foundation for the ISP is the business strategy plan for NSWCDD. A thorough understanding of NSWCDD's business strategy planning is essential to determine the future information needs of NSWCDD and to establish a consistent Information Strategy Plan that will support the future business requirements. In order to set priorities for the work identified by the analysis of information and functions required by NSWCDD in the performance of its business, we need to:

a. determine the business priorities from which the information priorities will be derived
b. identify the possible future developments of NSWCDD or external events, which should influence the direction of the automation efforts in the NICCS program as it supports the needs of NSWCDD
c. make the Board of Directors (BOD), and NSWCDD managers in general, aware of the possible impact of information technology on the way NSWCDD conducts its business

In the sections below each of these items are discussed.

2.1 Analysis of the Business

The current mission of NSWCDD is:

Provide research, development, test and evaluation, engineering and fleet support for surface warfare systems, surface ship combat systems, ordnance, mines, amphibious warfare systems, mine countermeasures, special warfare systems, and strategic systems. Execute other responsibilities as assigned by the Commander, Naval Surface Warfare Center.

The following guiding principles are from an internal draft of 12/18/91 on the mission, guiding principles, and vision for NSWCDD.

a. We exist to provide our customers with quality products and services, and to provide the Navy with a sound technical basis to obtain material resources required by the Fleet and the Marine Corps.
b. We will balance the two principle means to achieve this end:
   - be responsve to our customer's current needs to carry out assigned tasks
   - anticipate and prepare to support the Navy's future needs

c. We will be characterized internally by a culture which holds all employees as the foundation of our excellence.

Figure 2-1 lists the NSWCDD business goals based on this mission and guiding principles. Also included are the IRM goals set forth in the Master Plan[2] document for the NICCS program.

NSWCDD BUSINESS GOALS
1. Hire the best people, assign challenging work, provide them state of the art equipment and facilities, and create an environment that enables them to develop themselves and keep technologically current.
2. Be valued by our customers. Be recognized as a spokesman for technical truth, and a catalyst to promote the surface and strategic warfare communities' knowledge and use of technology.
3. Continue overall growth in technology based work, with increased emphasis on fundamental mathematical and physical principles, and on our ability to conceive and build prototypes.
4. Establish quality and process improvement as the cornerstones of providing our products and services, and in our business practices.

NSWCDD IRM GOALS
a. Plan and implement valid cost-effective information systems that are based on defined information requirements and that are designed to fully exploit current and emerging information technology to support and enhance NAVSWC mission performance.
b. Enhance command productivity through application of labor- and cost-saving programs to offset resource deficiencies.
c. Integrate, streamline, and simplify information resource and information systems acquisition to provide needed information resources in the most useful, timely, and economic manner.
d. Protect information from accidental, unauthorized, or intentional destruction, modification, disclosure, or denial of service.

Figure 2-1. NSWCDD Business and IRM Goals

Figure 2-2 contrasts the business goals of NSWCDD with those of NAVSEA laid out in their Information Resource Strategy Plan.[3]

NAVSEA BUSINESS STRATEGY / NSWCDD BUSINESS GOALS	Achieve efficiency of operation	Increase effectiveness and timeliness of acquiring and maintaining ships and combat systems for the fleet.	Sustain a technically superior Navy.	Maintain a professionally competent and motivated workforce.	Maximize / optimize the use of all corporate assets.
1. Hire the best people, assign challenging work, provide them state of the art equipment and facilities, and create an environment that enables them to develop themselves and keep technologically current.	✓	✓	✓	✓	✓
2. Be valued by our customers. Be recognized as a spokesman for technical truth, and a catalyst to promote the surface and strategic warfare communities' knowledge and use of technology.	✓	✓	✓	✓	
3. Continue overall growth in technology based work, with increased emphasis on fundamental mathematical and physical principles, and on our ability to conceive and build prototypes.		✓	✓	✓	
4. Establish quality and process improvement as the cornerstones of providing our products and services, and in our business practices.	✓	✓	✓	✓	✓

Figure 2-2. NSWCDD vs NAVSEA Business Goals

The current NSWCDD vision document[4] identified several strategic needs that relate to information management. These needs point to the diversity of information use at NSWCDD and to its importance to the success of NSWCDD.

a. The individual technical efforts be integrated across Departments and organizational units whenever those efforts have an impact on one another. We must build **effective information links** throughout the Center to keep managers, supervisors, and working level groups informed of one another's progress and use this information to strengthen the interoperability of the products that will ultimately be delivered to the Fleet.

b. The employment of **efficient business practices** to manage the public resources entrusted to us.

c. The Center is not simply the aggregate of a number of Departments acting independently of one another; rather, it is a collective whole, with all of the sharing many common interests, responsibilities, and problems.

d. The Center's business processes must take **maximum advantage of automation**, and the management information requirements of Center managers at all levels need to be met more effectively and efficiently.

e. The initiation of a concerted effort to meet Center managers' information needs, including implementation of **appropriate organizational change** required to meet these needs.

NSWCDD has not specifically defined any critical success factors, although the goals define what NSWCDD considers to be important in the pursuit of its business. Inhibitors include a scarcity of scientists and engineers forecast in the year 2000 coupled with the current salary structures within the Federal sector. The drawdown in DoD does not contribute to our ability to hire and retain the best people. NSWCDD has traditionally been conscious of providing technically current equipment. The information technology support in all areas of NSWCDD is quite good. Shrinking capital funds is an inhibitor to acquiring the needed information technology for the business support areas. The information resource initiatives in our parent organizations could be a help or an inhibitor, depending on the timing of mandated systems and the manner of implementation. The introduction of Total Quality Leadership initiatives within NSWCDD is a positive step in revamping the business processes. It affords an opportunity to automate improved processes, which is needed if the investment in automation is to be cost-effective. Automation of processes designed to be somewhat effective manually, without redesign to take advantage of automation, normally increases the life-cycle cost of the process - not improves it. On the downside, a surge of activity in this area can quickly and easily swamp the available resources for automation support. There may well be a need to cross traditional organizational boundaries to effect the best return. A very real inhibitor is the extreme vertical nature of DoD and its components. The preliminary work from CIM does not seem to go away from this perspective. When functionality is emphasized, the result often looks like the current environment. NSWCDD chose the data emphasis because its seems less sensitive to current vertical processes.

2.2 Drivers and their Impact

2.2.1 DoD Budget Cuts and Workforce Reductions

The DoD budget cuts and work level restrictions will cause changes in the way NSWCDD does its business. Cuts to the budgets of our sponsors will surely be felt in the funding profile. Reductions in direct money will require reductions in the overhead costs. One of the greatest challenges we face will be sustaining our ability to meet our responsibilities with fewer people. The improvement of business practices, whether by automation or not, must reduce substantially the numbers of people or the amount of personnel time involved in the business practices so that the generation of the NSWCDD products is less severely impacted.

2.2.2 DoD Corporate Information Management (CIM) Program

The CIM Program for the DoD is a very challenging and aggressive IRM initiative. CIM focuses on the improvement of business practices through consolidations and standardization. It will be operated in a centralized IRM policy and practices but decentralized execution mode. The Computer-aided Acquisition Logistic Support (CALS) Program has been placed under the CIM umbrella. CIM is aggressively pursuing other standards via increased funding to the National Institute for Standards and Technology (NIST). The Electronic Data Interchange (EDI) Program is also under CIM. The CIM approach will bring about massive changes in the way business is conducted in the DoD by enabling large-scale business process improvements. Their approach is similar to the approach being used by the NICCS Program. Both are using IE as the basic systems engineering approach. NSWCDD emphasizes data over function and CIM emphasizes function over data. CIM should provide NSWCDD with standardized automated programs and processes. The use of standard systems should lower our development and maintenance costs. The ISP and the following work on Business Area Analysis (BAA) will prepare NSWCDD for the incorporation of standard systems into its architectures.

2.2.3 Navy and NAVSEA IRM Initiatives

Both the Department of the Navy and NAVSEA are involved in IRM initiatives. In both cases those initiatives are endeavoring to remain consonant with the direction of CIM and NAVSEA with the DoN efforts. NSWCDD must endeavor to likewise satisfy the demands placed on it by these programs. DoN and NAVSEA both emphasize functionality over data, which is not the approach being taken by NSWCDD.

The Navy IR Strategic Plan[3] of April 1991 defines issues and objectives and gives the following emphases:

a. Management of information as a strategic resource

b. Realization of the Dod CIM initiatives wherein information is shared through an open systems architecture, systems are standardized, and resources are consolidated across and among the services.

c. Streamlined planning, programming, budgeting, executing and appraisal processes, life-cycle management processes, and acquisition processes that enable rapid achievement of mission objectives.

d. A data, computer, and communication structure that is acquired through full and open competition with heterogeneous technology transparent to its users and developers.

e. A military and civilian workforce that is highly competent and responsive to DoN-mission requirements.

NAVSEA states that its IRM goals are consistent with these DoN emphases. The NICCS Program has been moving in the direction of CIM and DoN emphases for NSWCDD since 1989. These initiatives of parent organizations will not cause any philosophical changes to the NICCS Program. The particular manner of fulfilling these objectives will vary from organization to organization. In the implementation arena, the NICCS program varies with both CIM and NAVSEA. The Business Areas developed by each organization reflects the particular needs of that organization to perform its mission. Each organization has similar goals but as we traverse down the change of command, each organization has a particular mission and the information systems needed to help it satisfy its particular goals will be implemented differently. The issues of effectiveness and efficiency come forward in the actual definition of Business Areas and their related information system strategies. The key is to have the IRM goals line up both with the business needs of the organization and with the IRM strategies of the parent organization. Figure 2-3 shows the relationship between the business goals of NSWCDD and its IRM goals. Figure 2-4 shows the relationship between the IRM goals of NSWCDD and the IRM strategies of NAVSEA. There is good correlation and support in both areas.

NSWCDD BUSINESS STRATEGY / NSWCDD IRM GOALS	Hire the best people, assign challenging work, provide them state of the art equipment and facilities, and create an environment that enables them to develop themselves and keep technologically current.	Be valued by our customers. Be recognized as a spokesman for technical truth, and a catalyst to promote the surface and strategic warfare communities' knowledge and use of technology.	Continue overall growth in technology based work, with increased emphasis on fundamental mathematical and physical principles, and on our ability to conceive and build prototypes.	Establish quality and process improvement as the cornerstones of providing our products and services, and in our business practices.
a. Plan and implement valid cost-effective information systems that are based on defined information requirements and that are designed to fully exploit current and emerging information technology to support and enhance NAVSWC mission performance.	✓	✓	✓	✓
b. Enhance command productivity through application of labor- and cost-saving programs to offset resource deficiencies.	✓	✓		✓
c. Integrate, streamline, and simplify information resource and information systems acquisition to provide needed information resources in the most useful, timely, and economic manner.	✓		✓	✓
d. Protect information from accidental, unauthorized, or intentional destruction, modification, disclosure, or denial of service.		✓	✓	

Figure 2-3. NSWCDD IRM vs Business Goals

NAVSEA IRM STRATEGY / NSWCDD IRM GOALS	Realization of NAVSEA Business Unit Information Management initiatives wherein information is shared through an OSE, systems are standardized, resources are consolidated, and CIM initiatives are utilized where provided.	Achieve a seamless, integrated data structure that makes use of mature data standard compliance, consistent information presentation, and electronic flow of information across the entire life cycle of the ship or weapons systems. This integrated data structure would provide a mechanism to manage data flow across the life cycle to ensure the right information at the right time in the format users needed.	Improve ability to receive and respond to business issues and actions and improve decision making capability.	Improve and streamline the business process through the use of Information Resource tools and technology.	Streamline discipline and control of the PPB, execution and appraisal processes, life cycle management process, and acquisition process within NAVSEA to enable rapid achievement of mission objectives utilizing upgradable technology.
a. Plan and implement valid cost-effective information systems that are based on defined information requirements and that are designed to fully exploit current and emerging information technology to support and enhance NAVSWC mission performance.	✓	✓	✓	✓	✓
b. Enhance command productivity through application of labor- and cost-saving programs to offset resource deficiencies.	✓	✓		✓	✓
c. Integrate, streamline, and simplify information resource and information systems acquisition to provide needed information resources in the most useful, timely, and economic manner.	✓	✓	✓	✓	✓
d. Protect information from accidentally, unauthorized, or intentional destruction, modification, disclosure, or denial of service.	✓	✓	✓	✓	

Figure 2-4. NSWCDD vs NAVSEA IRM Goals

2.2.4 Navy RDT&E Center Consolidation

The consolidation of the RDT&E Centers within the DoN will change the physical characteristics of NSWCDD. The shift in the locations of personnel and the addition of other physically distant sites will affect the communications backbone of NSWCDD. The addition of another major detachment and the reduction of a current detachment place even a larger burden

on the information sharing aspects of the NICCS program. The need for automation support in collaboration of research efforts and the production of non-hardware products and services is critical to the proper and effective use of personnel. The availability of business information and support at remote sites is accented.

2.2.5 Total Quality Management

NSWCDD is in the process of establishing a TQM environment. This change in organizational and mangerial philosophy will have a major impact on the design and implementation of information systems. Every other business change that has occurred in the past has been designed to move complexity out of the work environment and to move information handling up the organization ladder. Now, we are giving decision making responsibility to the lowest possible level. To be able to make decisions, the employees of NSWCDD will need information. Three things will affect the information processing scenario. First, the type of information will change at different levels from what it has been in the past. In particular, for TQM to work, each employee needs to know the vision, direction, and evaluation criteria that combine to tell him or her what constitutes success for the organization. Without this information, the employee cannot consistently make proper decisions; i.e., decisions that will move the organization on towards improved productivity and client satisfaction. Traditionally such information has been given selectively to managers at different levels. Now the field is wide open. Second, the field is wide open and since decisions will be being made by more people, the sources of information will be much more widely dispersed. At NSWCDD there is great physical distance between major locations and physical distances between people who need to share information at a particular site. The availability requirements and timeliness requirements still remain, and need to satisfy many more people. This need should affect technical design decisions; i.e., move away from large central databases because of potential reliability and performance problems. Third, TQM and IE have a great overlap in purpose and process.[5] NSWCDD will need to mesh its efforts in these two areas.

2.3 Impact of Information Technology

Information technology (IT) has and will continue to have a large impact on the way NSWCDD conducts it business and operates its business processes. The use of computing in support of the delivery of its products goes back over 40 years to the very early use of computers. The use of computers to process its business information dates back over 30 years. The introduction of the enterprise-wide office automation system 10 years ago set the stage for even greater acceptance of IT in most areas of work with the introduction of personal computers and workstations across the board. Despite the heavy automation within NSWCDD today many opportunities still exist for improvements based on judicious use of automation support.

At any enterprise, end user or client IT activities will vary in how sophisticated is their use of IT. The levels of sophistication and types of use constitute a maturity spectrum. Both clients and their applications can become more sophisticated if handled properly, or sometimes merely through the passage of time. The application maturity stage for the enterprise is taken to be the stage where the greatest proportion of client application development resources are

being expended. Figure 2-5 shows maturity stages of end-user computing.[6] It is possible to navigate NSWCDD through the stages. Currently NSWCDD is transitioning from Stage 2: Stand-alone to Stage 3: Manual Integration. This transition is marked by the emergence of significant volume of electronic, though manually controlled, data interchange. The next transition to Stage 4: Automated Integration will be marked by the development of automated data transfer systems and the development and use of the DA function. The NICCS Program is moving in this direction. The DA function is underway and is coordinating its activities with the DA activities of DoN and CIM. Some preliminary work has occurred to work out automated data exchange techniques, although it still has a long way to go. The long-range plans for NICCS, as discussed in Chapter 5, would move NSWCDD into Stage 5: Distributed Integration. The transition will involve moving to a distributed database environment. The technology is not available for production status. The NICCS Program has instituted a simulation laboratory to explore various alternatives for the technical architectures. One of the investigations underway involves distributed data processing in our environment.

2.3.1 [G] IT as a Product or Part of a Product

NSWCDD is already aware of the uses of IT as a product itself or as part of a product it develops. Quite a few of the products that are developed at NSWCDD are IT products. NSWCDD is heavily involved in the software business as it relates to support of its mission areas. NSWCDD uses CAD/CAM and visualization graphics in its hardware business. Within the industry, automation efforts to support feasibility and design is moving into new areas; e.g., virtual reality environments are a big leap from conventional training simulators and test networks. The use of information technologies of the future are being explored now at NSWCDD.

2.3.2 [Y] IT as a Medium for Delivering Products

This area will continue to evolve in response to the DoD CALS Program. The NSWCDD CALS Program is working with NICCS and has some programs experimenting with the CALS standards as they come out. The use of hypermedia techniques and technologies could change the way NSWCDD delivers its products. Some programs are now trying hypermedia techniques in the training and maintenance areas.

2.3.3 [R] IT as a Marketing Instrument

NSWCDD does not use automation in support of this function. With the reorganization of the RDT&E community, it might appear on the surface that this is no longer an important function. The centers are no longer to compete with each other but have their areas of expertise defined. NSWCDD works in many leading-edge automation technologies; e.g., neural networks. The fact remains that the centers must compete with the private sector for work and

Stage 1: ISOLATION
- o little or no exchange of data or programs with other applications
- o applications more for understanding than to perform substantial work-related tasks
- o laissez-faire management; i.e., no attempt to support end user computing
- o largely no enterprise-wide planning and control for end user computing
- o *largely no end user computing support or training*

Stage 2: STAND-ALONE
- o end user dependence on applications is observable
- o applications restricted to client or his/her work group
- o data passed by manual methods
- o begin to establish procedures for the evaluation and acquisition of new end user hardware and software
- o initial operating policies and procedures introduced for backup, recovery, security
- o end user support group assists in hardware and software evaluations

Stage 3: MANUAL INTEGRATION
- o clients exchange substantial amounts of data and/or programs with each other
- o data transfer is not integrated within the application but occurs manually external to the application
- o need some standardization between applications exchanging data leading to data administration function
- o requirement for cost-benefit analysis for client systems
- o emergence of application development discipline

Stage 4: AUTOMATED INTEGRATION
- o advent of true integrated systems
- o clients and developers must possess information on where data exists and how to best get to it for new application development
- o linking of client community with the central systems group
- o competent and effective management of data at all levels of computing power becomes critical to the business functioning of the enterprise
- o clients are required to adopt an application development discipline
- o less client freedom because of need for interoperability

Stage 5: DISTRIBUTED INTEGRATION
- o shared databases exist at desktop, organization and enterprise levels
- o *standardized software*
- o use of distributed database systems, multi-level dictionaries, and other network/system tools *[not currently available]*
- o increasing number of senior managers use microcomputers because information from all aspects of the business is more readily accessible
- o teams developing sophisticated cross-functional applications

Figure 2-5. Stages of End-User Computing

will still compete for block money. In an intensely competitive arena, marketing becomes very important. With DoD budgets being cut substantially, there will be intense competition for scarce funds. NSWCDD could apply automation support in this area, much like the private sector in the gathering of our own type of marketing data. NSWCDD does strategic planning from the top-down and should be using marketing forecasting to project what areas and sponsors it should be working. NSWCDD does not have a well-defined marketing approach at this time, which makes automation support in this area difficult. This area has potential for pay-off in the future environment of more competition for less resources.

2.3.4 [R] IT as a Competitive Tool of Management

One of the main drivers for the NICCS Program was the awareness at NSWCDD that its information systems, particularly its business systems, were not supporting the needs of management. NSWCDD needs integrated information in its decision-making as it positions itself in the near and the long terms. Isolated pockets of information technology support have occurred, but the integration is not there. Information technology is being applied in the personnel area the most effectively. The financial systems are terrible as is to be expected when an almost 20 year moratorium on their upgrade was endured. Obtaining of financial goals is difficult because the proper information is not available throughout the year to make adjustments to strategies and plans. Lack of good IT support places a drain on productive time throughout the organization as fire drills and information gathering is performed manually and there is no ability to use previously gathered data in a new slant. This ISP and the ensuing work has as their goals the solution to these problems of good, reliable, timely, and integrated management information.

2.4 Strategic Issues and Priorities

NSWCDD has an operational need to perform its business functions using fewer resources than its current baseline, by at least 25 percent in the personnel resource. This need is driven, not by possible drawdowns, but because the overhead expenditures need to be lowered. The reduction in direct dollars to NSWCDD is a real threat and would need fewer overhead dollars to be expended to keep the rates the same. This reduction must not lengthen the mean-time-to-complete any basic business function and maintain, and perhaps enhance, the integrity and repeatability of the NSWCDD decision-making. This need is borne out of the external environment of DoD budget cuts, drawdowns and to help NSWCDD lower its rates by lowering its overhead expenditures. This need is probably the primary driver for the NICCS program.

The second need relates to the real business of NSWCDD. NSWCDD has a need for better information flow within the bounds of its organization and with outside sources. The information, which needs to flow, is both technical and business. NSWCDD is in the knowledge business since it is an R&D center. The need for information flow for collaboration is high and the need to easily and effectively access information sources outside of NSWCDD would be a

productive boost to the technical staff. Managers need better business information in a more timely fashion and in a better presentation style.

The final need is a more effective use of IT in the support of managers. NSWCDD uses information technology in the generation of its products, but needs to better utilize the capabilities of automation support in the other areas. The need to perform its business functions more effectively and the lack of automation in marketing and general decision-making, both at an enterprise level and an organizational unit; e.g., branch, program, office, requires NSWCDD to move through the stages of end-user computing as described above.

The two key dimensions of moving through the stages are (1) the rate of expansion of client application development and (2) the direction of its development; i.e., how applications are developed. The expansion dimension may be affected by manipulating such things as the flow of information to the client community, costs borne by the clients, the availability of capitalization funds to acquire new technology, and the support and assistance provided to the client community. The direction that development takes can be controlled by restrictions placed on hardware and software selections, platform usage policies, and the nature of access to the NSWCDD corporate database(s). Figure 2-6 shows four development strategies depending on the level of expansion permitted and the level of control exerted by the central systems group.

Many external and internal drivers to the NICCS Program would affect how we try to manage in this grid. Flexibility is the key in the current business environment of NSWCDD. Some examples of different strategies follow. Tight IT budgets but loose budgets in the client areas might lead to acceleration or controlled growth, depending on how good we are in the standards and policies arena at that point in time. Lack of expertise in the business client areas might suggest containment as a strategy, while we work on bringing their skill levels up to a level that we feel comfortable with them developing their own systems under our guidelines.

Expansion	Control	Development Strategy
Low	Low	Laissez-faire: little or no interest in expanding client computing and little controls in place
Low	High	Containment: client computing is developed slowly and carefully in a highly controlled environment
High	Low	Acceleration: encourages or allows client computing to develop rapidly and few controls in place
High	High	Controlled Growth: client computing is developed rapidly but in a carefully controlled environment

Figure 2-6. Development Strategy Grid

CHAPTER 3

INFORMATION ENVIRONMENT

3.1 Current Information Environment

Center management has recognized the symptoms that indicate problems with our current information environment. The white paper[7] produced by the Finance and Business Systems Board highlighted *"our inability to get accurate and appropriate information to the right people at the right time"*. What are the characteristics of our information environment that led to this conclusion?

Over the years, an inventory of information has built up in paper files, punched cards, magnetic tape and disks and, in some cases, in people's heads. Although we have this information resource, there must be some inherent limitations associated with it that cause the problems cited above. Indeed, the problems with this inventory of information actually originate from the design approach that produced it. Until very recently, we designed information systems to functional specifications; i.e. designed based on what the system had to do. Data, rather than being the driving design force, only supported the particular functional requirements of the system. The result is data customized for each and every application. Data repeated for each application that needed it. This approach to systems design caused some worrisome problems; e.g., lots of source code and data files to maintain and inconsistencies in data definitions. But, the approach generally was workable in the world of stand-alone systems, hardcopy reports, and undemanding clients.

Today's clients are more demanding of information technology; they want systems that give them the information they need when they need it. They have become more aware of the possibilities afforded by information technology. They witness the advances at the checkout counter, the bank, and virtually every facet of their lives. Clients expect flexible systems that can meet their changing needs and meet them rapidly. To meet these expectations, the design focus must not be on what the system has to do, but on what information the system has to provide. Thus, data must become the force that drives systems design.

The current NSWCDD information environment is a product of the functionally driven design approach. Most of our business systems are written in second generation COBOL and are supported by flat data files. Some data are even embedded in application programs or in the job control statements that run them. Data definitions and formats are not standardized, so data are more frequently replicated than shared. Redundant data files are commonplace and expensive to maintain. In short, our current information environment cannot effectively support NSWCDD in the rapidly-changing, information-intensive, competitive business world in which we find ourselves.

3.2 Defining A New Information Environment

The information environment to which NSWCDD must transition will be characterized by data stored in relational databases; defined and standardized from the enterprise perspective, and independent of the specification of any particular application. Applications will share data, not own it. Clients will be able to access databases and extract the data they need. Many requirements for information will be handled by the databases, without any programming at all. This environment requires that information be managed as a resource, just like the financial, human, and physical resources that support NSWCDD's mission.

3.3 Information Architecture

The heart of the specification baseline for the new information environment is the set of models that comprise the Information Architecture. Enterprise analysis considers the data used and the activities performed by the enterprise and defines the function and data models. The objectives of this analysis to:

a. develop a view of NSWCDD functions independent of organizational structure
b. identify the fundamental categories of data that are important to NSWCDD
c. develop a view of how data is used to support NSWCDD functions

In the sections below , we will discuss the function and the data models. These two models make up the Information Architecture. Both the models and the processes used to define them will be discussed. Finally, the interaction of function and data will be discussed and the ramifications on NSWCDD.

3.3.1 Functional Model

An objective of ISP is to develop a functional model of the enterprise that is not influenced by existing organizational structure. Therefore, emphasis was placed on "what" NSWCDD does, and not on "who" does it. A functional decomposition diagram describes the function model. Although these diagrams look much like organizational charts, we must remember that the function model defined by the ISP project is independent of organizational structure. This purely functional view allows opportunities for process improvement and data sharing from a neutral, non-parochial point of view.

NSWCDD accomplishes its mission by responding to the needs of the surface Navy. These needs are sometimes expressed to NSWCDD through sponsor organizations and sometimes are identified through the R&D activities of NSWCDD itself. A top-level view of NSWCDD reveals three major functional areas as shown in Figure 3-1. The *Product and Service Development* functional area determines the requirements for responding to those needs and communicates the requirements to the *Organization Management* area. *Organization Management* then authorizes allocations of resources to be provided by the *Resource Management* functional area.

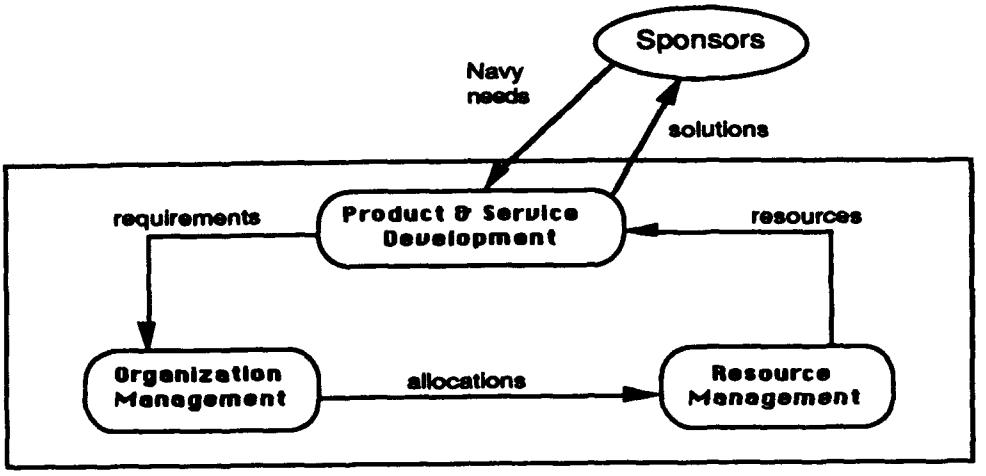


Figure 3-1. NSWCDD Stimulus-Response Model

Although this representation of NSWCDD is extremely simplified, it does provide a structure for thinking about the major functions necessary for NSWCDD to do its business. From this conceptualization, the ISP Functional Model was developed. The Resource Management functional area divides further into the six resource specific areas. Figure 3-2 shows the top-level ISP Function Model.

The functional decomposition is verified by a technique known as functional dependency analysis. We analyzed information flows between functions to ensure that information required as input to one function is available as output from another function within the decomposition. As each high level function is decomposed, we analyzed its subfunctions in terms of their dependency on one another. In other words, each subfunction must either provide information to, or receive information from, another subfunction of the same parent function. If this criterion is not met the validity of the decomposition should be questioned.

This first step ensures dependencies between subfunctions under each parent function. We then analyze dependencies between functions at a particular level of the decomposition; i.e. all level 1 functions are analyzed, then all level 2 functions, etc. This process helps to attain a consistent level of detail in the functional model. Appendix A contains the functional dependency diagrams used to validate the ISP Functional Model. To get the detailed definitions of the functions at all the levels of the model, contact the Systems Division.

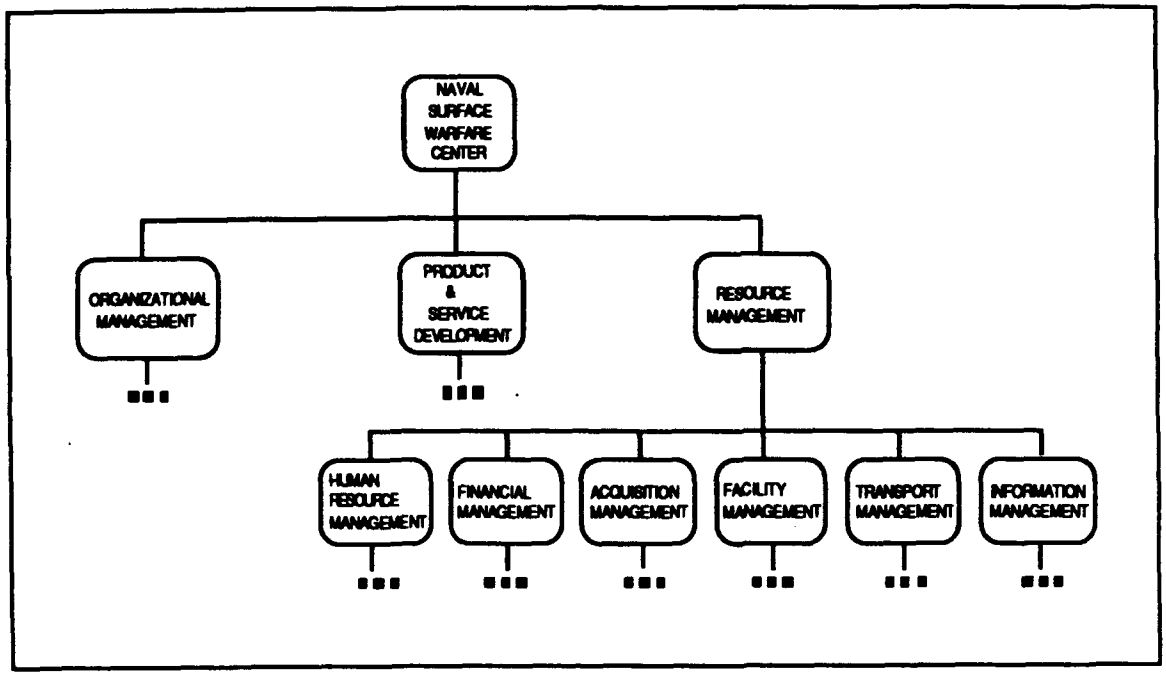


Figure 3-2. NSWCDD Functional Decomposition Diagram

3.3.2 Data Model

The data model developed during ISP represents the major categories of information (entity types) that are important to NSWCDD. The model is, therefore, relatively high level, but represents the overall character of the business of NSWCDD. Later stages of the methodology will add significant detail to the model and will transform the logical data model to physical database design.

We used entity-relationship (E-R) modeling to develop the data model. E-R modeling "involves identifying things of importance in an organization (**entities**), the properties of those things (**attributes**), and how they are related to one another (relationships)."[8] The objectives of E-R modeling can be summarized as follows to:

a. provide an accurate representation of the information needs of the enterprise, which can be used to guide development of new or improved systems

b. provide a model that is independent of any particular data storage or access method allowing objective implementation decisions to be made

The data model is represented in an entity-relationship diagram (ERD). Appendix B contains supplemental information about the syntax and semantics of E-R diagramming that may be helpful for the reader unfamiliar with ERD constructs. The appendix contains the complete data model, as defined by the ISP project. The data model consists of 48 entity types.

Data integrity rules can be built into the database implementation rather than into every application that uses the data. This ability provides a significant benefit by reducing the complexity of applications. Reducing complexity lessens the maintenance the rules require and increases the quality of the data used by the organization. Entity relationship modeling, by the rigorous definition of relationships between entities, provides a means for the incorporation of these rules into the data model.

3.3.3 Function/Entity Type Interaction

As we developed the functional and data models, consideration was given to how the functions and entity types interact; i.e. which functions perform create, delete, update, and read operations on the data. We documented the information in an association matrix, which is sometimes called a CRUD chart. The matrix lists the lowest level functions (processes) in rows, the entity types in columns, and records either a C, R, U, or D in the appropriate cell to indicate the kind of interactions that can take place. By convention, only a single interaction code is entered into a cell, so a hierarchy of interactions is used.

C in a cell means the process may create, delete, update, and read that entity type
D means the process may delete, update, and read the entity type
U means the process may update and read the entity type
R means the process may only read the entity type

Figure 3-3 shows a partial CRUD matrix to introduce these concepts; Appendix C contains the complete ISP CRUD matrix.

The first thing that we should observe about the matrix is that it is not a very sparse matrix; i.e., many of the cells contain entries. This is a strong indication of why an applications environment will not work for NSWCDD. In an applications environment, several of the functions would be grouped together, and the data that they need would be defined. A database containing the required data would be designed and developed. Then another set of functions would be chosen and their required data would be defined. The problem is that this group of defined data needs will almost surely contain data already defined and processed by the first set of functions. If the data is repeated for both sets of functions, an enormous maintenance problem arises as both data stores must be populated and updated. An enormous data consistency and reliability problem will also arise as the updates to the data go out of synchronization, updates and corrections are only made to one set, and the other is missed, etc. The only solution is a logically defined corporate database. In this scenario, all data for the enterprise is managed

Function \ Entity Type	ACTION REQUEST	CONCEPT	LEGAL AGREEMENT	NAVSWC SERVICE	NAVSWC PRODUCT	ORGANIZATION	PERSON	PROGRAM	PROPOSAL	SPONSOR
ACCEPT & ALLOCATE FUNDS						U				
ASSESS NAVY NEEDS		C								
ASSESS TECNOLOGY TRENDS		U		R	R			R	R	U
ASSIGN WORK							U			
COLLECT RECEIVABLES							U	U		U
CREATE PROGRAM				C	C	U		U	U	U
DELIVER MATERIAL					U	U	U			
DETERMINE SPONSORS								C	R	U
DEVELOP ORGANIZATION OPTIONS		U						R	R	R
DEVELOP PROPOSAL		U					R		C	U
DISBURSE PAYABLES							U			U
ESTABLISH MATERIAL CONTROLS					U					
EXECUTE PROGRAM						U		U		U
IDENTIFY INFORMATION REQUIREMENTS	R			R	R					
ISSUE STOREROOM INVENTORY	U						R			
MAINTAIN MATERIAL ACCOUNTABILITY	R						U			
MANAGE PERSONNEL PERFORMANCE	R					U	R			
MANAGE TIME & LABOR			R				U			
MARKET PROPOSAL								R	U	C
PERFORM ACCOUNTING	U			U		U	U			
PROCESS PROCUREMENTS	U									

Create
Read
Update
Delete

Figure 3-3. Partial Function/Entity Type Association Matrix

as if it were one large database. The functions that need the data will use the one logical definition of the data. This is not to say that there will be one enormous physical database. The implementation strategy could be handled several ways. The point is, however, that for the developers of an application the data is defined and the definition and usage rules are maintained centrally. When the technology catches up to the concepts, the application developer would not need to know physically where the data resides, but would only tell the data repository system that certain pieces of data were needed to be processed. The system would be a transparent

conduit between the application and the data stores themselves. The system would enforce consistency and integrity rules, as well as access privileges.

The second aspect of the non-sparcity of the matrix deals with implementation issues. If we were in a straight technology-driven implementation environment, we would move toward first defining and implementing those entity types that are used by the most functions. Even in a pure technology-driven scenario there would be problems. Instead we will be defining and implementing the entity types and functions that will permit us to satisfy the most important needs of NSWCDD. This will create more problems about how to preliminarily define and implement our systems. For example, the entity type called Directive is used by almost every function on the matrix. Without access to the information represented by this entity type, almost no function could be properly implemented in practice. The problem is that we need to implement in chunks of functions and their corresponding entity types, but the full use of a particular entity type may not be known until several chunks later. We should remember at this point, that automation is not assumed. Access to an entity type does not mean that the entity type must be maintained in an automated state.

3.3.4 Data Sharing and Distribution Requirements

The functional model is developed without regard for organizational structure. Its purpose is to represent a purely functional view of NSWCDD, which should be relatively stable over time. Once the function and data models have been developed, however, consideration of organizational structure and physical location can lead to inferences about how data can be shared and distributed to optimize support of NSWCDD's business.

We analyzed the functions and data within the context of the organizational structure. Matrices show associations of processes and data with the organizational units that use them. Figure 3-4 presents a matrix that associates the lowest level functions from the functional decomposition with the organizations that perform them. We defined the organizational structure only down to the department level, which is a level sufficient for ISP purposes. Finer analytical granularity will occur during the analysis stage of the methodology. The matrix indicates the distribution of business functions throughout NSWCDD and shows that many functions are performed by all or nearly all the organizations considered. As might be expected, functions dealing with *planning, review and evaluation, management of resources*, and *safety and security* appear in the matrix as the responsibility of all organizational units.

We determined an organization's responsibility for data. We used the Function / Organizational Unit matrix to identify which functions an organization performs. We then determined how those functions interact with entity types by using the CRUD matrix. The Entity Type/Organizational Unit matrix, as shown in Figure 3-5, shows responsibility by organization for the creation or update of the data entities.

Function \ Organization Unit	ECD	C/D	E	F	G	H	J	K	M	N	P	R	S	U	W	Tenants
DEVELOP ORGANIZATION VISION	✓	✓														
DEVELOP ORGANIZATION DIRECTION	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
DEVELOP COORDINATED PLANS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DETERMINE MANPOWER REQUIREMENTS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
DEVELOP INFORMATION GUIDANCE	✓		✓													✓
CONSOLIDATE BUDGETS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DEVELOP PROGRAM PLAN			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MONITOR PROGRAM	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ANALYZE & REVIEW FINANCIAL MGT.	✓	✓							✓							
REVIEW ORGANIZATION EFFECTIVENESS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CLASSIFY POSITIONS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RECRUIT PERSONNEL		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HIRE PERSONNEL											✓					
REASSIGN PERSONNEL		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
STRUCTURE ORGANIZATION	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
REQUEST/AUTHORIZE RESOURCE USE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ASSIGN WORK		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MANAGE TIME & LABOR		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MANAGE PERSONNEL PERFORMANCE		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TRAIN PERSONNEL		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PROVIDE PERSONNEL SERVICES											✓					✓
ASSESS NAVY NEEDS	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓		✓
ASSESS TECNOLOGY TRENDS			✓	✓	✓	✓	✓	✓		✓		✓		✓		✓
DEVELOP ORGANIZATION OPTIONS	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
DEVELOP PROPOSAL			✓	✓	✓	✓	✓	✓		✓		✓		✓		
MARKET PROPOSAL		✓	✓	✓	✓	✓	✓	✓		✓		✓		✓		
DETERMINE SPONSORS	✓	✓														
CREATE PROGRAM	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
EXECUTE PROGRAM			✓	✓	✓	✓	✓	✓		✓		✓		✓		✓
ACCEPT & ALLOCATE FUNDS				✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
RECONCILE & CLOSE AUTHORIZATIONS									✓							
DISBURSE PAYABLES									✓							
COLLECT RECEIVABLES									✓							
PERFORM ACCOUNTING									✓							
SCREEN REQUISITIONS													✓			
PROCESS PROCUREMENTS													✓			
RECEIVE AND INSPECT MATERIAL		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RECEIVE & CERTIFY SERVICES		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DELIVER MATERIAL													✓		✓	
ISSUE STOREROOM INVENTORY													✓			
ESTABLISH MATERIAL CONTROLS		✓	✓										✓			
MAINTAIN MATERIAL ACCOUNTABILITY		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDENTIFY INFORMATION REQUIREMENTS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ANALYZE INFORMATION REQUIREMENTS			✓													
COORDINATE DEVELOPMENT PROJECTS			✓													
DESIGN INFORMATION SYSTEMS			✓													
DEV. INFO. POLICIES & STANDARDS			✓													
DEVELOP INFORMATION ARCHITECTURE			✓													
IMPLEMENT INFORMATION SYSTEMS			✓													
CREATE INFORMATION PRODUCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MAINTAIN INFORMATION			✓													
DISTRIBUTE INFORMATION			✓													
DETERMINE INFORMATION AVAILABILITY			✓													
DESIGN FACILITY/UTILITY															✓	
CONSTRUCT FACILITY															✓	
OPERATE FACILITIES & UTILITIES															✓	
MAINTAIN FACILITIES & UTILITIES															✓	
SCREEN TRANSPORT REQUESTS															✓	
MAINTAIN VEHICLES															✓	
MANAGE TRANSPORT OPERATIONS															✓	
SAFEGUARD PERSONNEL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SAFEGUARD MATERIAL & EQUIPMENT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SAFEGUARD FACILITIES & UTILITIES	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 3-4. Function/Organization Association Matrix

Entity Type \ Organization Unit	BOD	C/D	E	F	G	H	J	K	M	N	P	R	S	U	W	Tenants
STRATEGIC PLAN	✓	✓														
DIRECTIVE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HUMAN RESOURCE PLAN	✓	✓									✓					
FACILITY PLAN	✓	✓													✓	
MATERIAL/SERVICES MGT. PLAN	✓	✓											✓			
TRANSPORT SERVICES PLAN	✓	✓													✓	
INFORMATION MANAGEMENT PLAN	✓	✓	✓													
PROGRAM PLAN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
BUDGET	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LABOR RATE									✓							
ASSESSMENT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
POSITION DESCRIPTION											✓					
PERSON	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ORGANIZATION	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ACTION REQUEST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LEGAL AGREEMENT		✓									✓					✓
TASK	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CONCEPT	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓		
PROPOSAL		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		
SPONSOR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		
PROGRAM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
TASKING ORDER									✓							
NAVSWC SERVICE	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
NAVSWC PRODUCT	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		
SPONSOR ORDER									✓							
COST ACCOUNT									✓							
JOB ORDER NUMBER									✓							
CASH TRANSACTION									✓							
FINANCIAL TRANSACTION	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CUSTOMER BILL									✓							
PAYABLE INVOICE									✓							
PROVIDER									✓				✓			
PROCUREMENT LINE ITEM			✓						✓				✓			
PROCUREMENT DOCUMENT													✓			
STOREROOM INVENTORY													✓			
PLANT PROPERTY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CONTROLLED MATERIAL	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
HAZARDOUS MATERIAL PROPERTIES		✓	✓										✓			
SECURITY CLASSIFICATION		✓	✓													
INFORMATION MODEL			✓													
INFORMATION SYSTEM			✓													
TECHNICAL INFORMATION	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
INTEROFFICE COMMUNICATION	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FACILITY													✓		✓	
UTILITY															✓	
VEHICLE															✓	
INSPECTION		✓	✓										✓		✓	
VIOLATION	✓	✓									✓					

Figure 3-5. Entity Type/Organizational Association Matrix

3.4 Sharing and Distribution Conclusions

The Entity Type/Organizational Unit matrix reveals that the following entity types are used by every organization considered in this analysis:

DIRECTIVE
PERSON
ACTION REQUEST
PLANT PROPERTY
INTEROFFICE COMMUNICATION
BUDGET
ORGANIZATION
FINANCIAL TRANSACTION
TECHNICAL INFORMATION

Therefore, a significant requirement exists to share these data across organizational units. The matrix in Figure 3-5 reflects only the organizations' responsibility for creation and update of entity types. Consideration of an organization's need to read entity types would demonstrate an even greater requirement for data sharing.

Observations can be made relative to these matrices. For example, the Function/ Organizational Unit matrix in Figure 3-4 shows no overlap of the primary functionality of the Comptroller Department (M) and the Supply Department (S). However, the Entity Type/ Organizational Unit matrix in Figure 3-5 clearly shows that these two departments need to share data in the execution of their fiduciary responsibilities; e.g., PROVIDER, PROCUREMENT LINE ITEM, and PLANT PROPERTY. Analysis of these matrices will help in the future analysis and development of systems to ensure that the right players are enlisted for the client teams.

Figure 3-6 shows the geographical dispersion by organizational units. It shows that nearly all departments have contingents at the White Oak Maryland and Dahlgren Virginia sites. Relatively small contingents at the remote sites; i.e., Wallops Island Maryland, Ft. Monroe Maryland, Ft. Lauderdale Florida, will also require service and will therefore have an influence on the definition of the Technical Architecture. Base consolidation and realignment initiatives altered the geographical locations in which NSWCDD operates. The ISP established an architectural baseline for NSWCDD prior to the consolidation. The baseline will need to be changed.

Location \ Organization Unit	BOD	C/D	E	F	G	H	J	K	M	N	P	R	S	U	W	Tenants
Dahlgren, VA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
White Oak, MD	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Wallops Island, VA										✓						
Brighton Dam, MD														✓		
Ft. Monroe, VA														✓		
Ft. Lauderdale, FL			✓											✓		

Figure 3-6. Location by Organizational Unit Matrix

CHAPTER 4

SYSTEMS ENVIRONMENT

4.1 Current Business Systems Environment

NSWCDD's current business systems environment is typical of those found in organizations still in the early stages of data processing evolution.[9] NSWCDD has over 100 stand-alone business systems running on different platforms with little automated exchange of data. NSWCDD does have a large office automation system, which is the official information media for NSWCDD. Specialized interfaces between it and some of the business systems have been developed, which permit reports from a business system to be distributed via the e-mail capabilities of the office automation system. Some NSWCDD organizations have installed their own local area networks, which are not very compatible with the official office automation system. A look at some of the forces that shaped this environment not only provides understanding of how we got where we are, but also suggests ways we can evolve to meet present and future needs.

Early automated data processing was primarily concerned with providing applications to reduce the cost of executing business procedures. For this reason, and because of the limited capabilities of information technology, information systems tended to be limited to automation of the existing manual procedures. Functional requirements of a particular operational segment of the enterprise drove the design of these systems. For example, the comptroller might automate the payroll or the supply organization might automate stock control. They tended to be restricted to meet a rather narrow set of needs. For the most part, connectivity between systems did not exist and systems were certainly not designed to share data with other systems. Systems with these characteristics are referred to as "vertical" systems. Data related problems that arise from such a systems environment were addressed in Sections 3.1 and 3.3.3.

The vertical nature of NSWCDD's systems environment is evident in the difficulty associated with sharing data. Data sharing between systems usually requires creation of extract files, data format conversions, and significant manual editing to complete the task. Clients get data in the form of hardcopy reports that offer little flexibility in either format or content.

Another important characteristic of our current systems environment is the high cost of maintaining the existing systems. Since NSWCDD's current system environment is a product of years of automating processes and procedures, one could expect it to be characterized by high maintenance cost. Figure 4-1 depicts the widely acknowledged statistic that 70% of the total life-cycle cost of information systems goes to maintenance. A closer look at this statistic reveals that only about 20% of that cost is applied to corrective maintenance; i.e., fixing coding errors. Nearly 80% is applied to adaptive maintenance; i.e., enhancements to the systems to satisfy additional requirements of the clients. Older systems often show degradation in

maintainability over time. The move to IE supported by CASE tools is to reduce the life-cycle costs of information systems in corrective maintenance. The move is also to produce systems better meeting client needs and thereby reducing the adaptive maintenance costs as well. A tenet of the IE methodology is that by designing systems around the data that changes the least often, we will have a more stable and flexible systems environment.

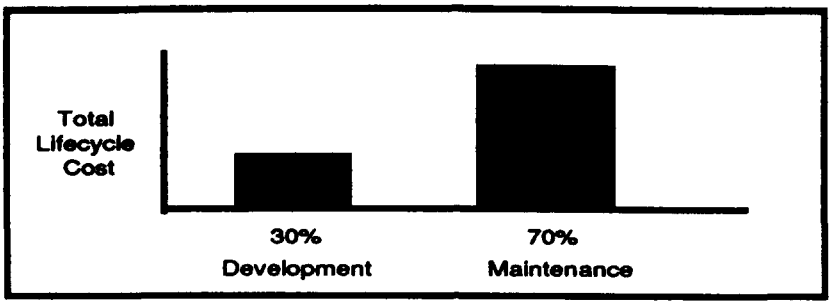


Figure 4-1. Information Systems Life-cycle Cost Distribution

4.2 Defining a New Business Systems Environment

Evolving to a new business systems environment will require management of information as a corporate resource. This environment will be characterized by systems that share data with other systems through corporate databases. Data will be created once at the source and then used wherever needed throughout NSWCDD. The new systems environment also supports the information needs of the whole enterprise, in addition to supporting the functional requirements of particular business areas. The objectives of defining a new business system environment are to:

a. show the likely future environment of systems and databases that will meet the overall needs of NSWCDD

b. provide a basis for planning of future analysis and systems development to ensure compatibility between systems and with databases

c. provide a basis for determining and revising the technical architecture

Without such an environment, we will continue to build systems and databases in isolation and perpetuate the problems of redundant data and complex data exchange mechanisms. The goal of this effort is in effect a framework for the future development of business systems. It is derived from the Information Architecture but adds practical factors such as mandated systems, available technology, and business policies. As priorities change or technologies change, we will be better able to make intelligent decisions in response to those changes. Being in a business system environment permits us to understand the interdependencies needed for proper sequencing and scoping of the subsequent analysis and development projects.

4.3 Business Systems Architecture

Chapter 3 presented the Information Architecture which lays out the information requirements of NSWCDD. The objective of this section is to present a view of the systems and databases needed to satisfy those information requirements. This view of the target systems environment is called the **Business Systems Architecture.** It will serve as a basis for information system development in the future. The benefits from developing a business systems architecture are as follows:

a. provides a means to control data redundancy and flow between processes

b. provides a means to scope and prioritize the requirements established by the information architecture into development projects that can be managed with available resources

c. provides guidance to the definition of the technical architecture

The Business Systems Architecture is developed from the data entity types and processes of the Information Architecture. We need to understand the interrelationships between functions, between entity types, and between functions and entity types. We generated a hierarchy of visual representations to show the various relationships. The diagrams help validate the relationships, which are codified in the CASE tool. Figure 4-2 shows the diagram for the high level function of Financial Management. Figure 4-3 shows the diagram for Administer Funds within Financial Management. It has two more processes. The later analysis is performed at this lowest level; e.g., Accept & Allocate Funds. Appendix A discusses how to read these diagrams and contains the full set. Clustering of CRUD interactions between processes and entity types produces groups of entity types and groups of processes. The groups are referred to as natural data stores and natural business systems, respectively. Each of these groups will be discussed below. Clustering is based on the mathematical process of affinity analysis, which calculates the similarity between pairs. We performed separate clusterings for entity types and for processes.

The IEW tool performs the affinity calculations using the interaction entries stored in the CRUD matrix shown in Appendix C. The tool produces a report of the computed affinity values. Natural business systems are then defined as groups of processes with high affinity; i.e., they support a highly related set of functions that are all interdependent and are all involved with basically the same entity types. Likewise, natural data stores are defined as groups of entity types that have high affinity for one another. We define business areas by bringing together collections of natural data stores and natural business systems. Business areas establish the boundaries for projects that will undergo further analysis.

Without the use of a CASE tool, affinity analysis would not be performed. Affinity calculations are made for all permutations of pairs of objects. The information architecture contains 48 entity types and 61 processes. The sheer volume of calculations would make this kind of analysis practically impossible to perform without automated support.

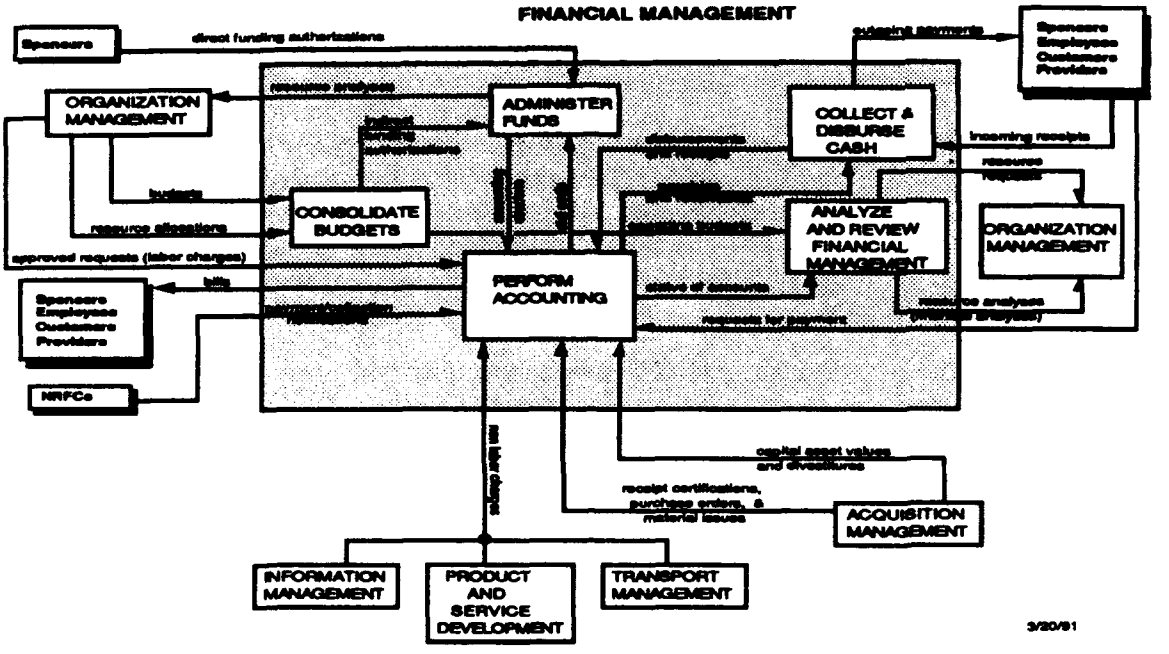


Figure 4-2. Financial Management Diagram

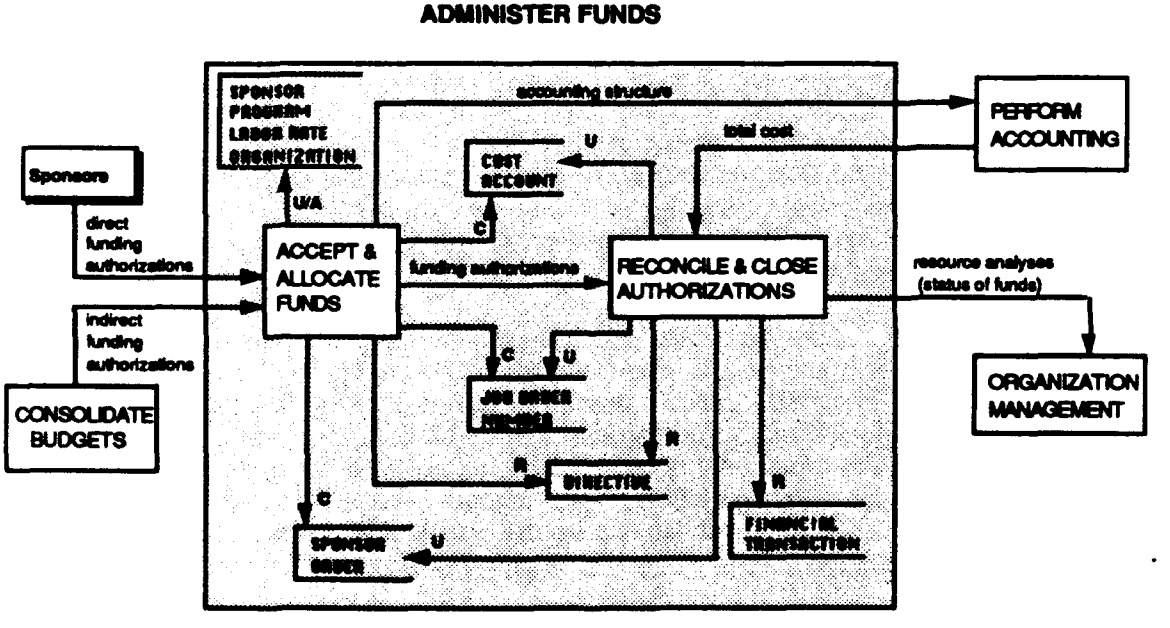


Figure 4-3. Administer Funds Diagram

Figure 4-4 shows that almost 6000 calculations were required for each iteration of the affinity analysis.

Permutations of n objects taken m at a time = $P_{n,m} = \frac{n!}{(n-m)!}$

$$P_{48,2} = \frac{48!}{(48-2)!} = 2,256$$

$$P_{61,2} = \frac{61!}{(61-2)!} = 3,660$$

Figure 4-4. Volume of Calculations Required to Perform Affinity Analysis

4.3.1 Data Stores

A data store is a collection of information that can be repeatedly and non-destructively accessed. Data stores can be either automated or manual, and can consist of a single entity type or several entity types. Natural data stores are a product of the clustering technique which groups together highly related entity types. These data stores are natural in the sense that the affinity that exists between entity types is based on their use only. We do not consider technical or political factors that may influence the grouping of data. Figure 4-5 displays the Entity Type within Data Store Table which indicates the grouping of entity types into natural data stores. Future analysis will divide these general categories into much finer detail. Appendix D shows the data flow diagrams.

4.3.2 Business Systems

A business system is a collection of processes that support a particular functional area of NSWCDD. Like data stores, systems may be either automated or manual. Again, the objective is to identify natural business systems; i.e., groups of processes that have interactions with the same entity types. Natural business systems are identified based on the affinity between processes and without consideration of technical, organizational or political factors. The natural business systems and the processes that make them up appear in the Process within Business System Table in Figure 4-6. We have split the lower-level functions from their parent functions and regrouped them according to their use of the entity types. The business systems now no longer match the functional decomposition depicted in Figure 3-2. A single business system may cross several top-level functions. For example, the Business System called "Review & Evaluation" has three processes associated with it. Each process comes from a different high level function, i.e., Monitor Program from the Product & Service Department function; Analyze & Review Finance from the Financial Management function; and Review

ACTION REQUESTS
- Action Request

ASSESSMENTS
- Assessment

BILLS
- Customer Bill

BUDGETS
- Budget
- Labor Rate

CONCEPTS
- Concept

CONTROLLED MATERIAL PROPERTIES
- Hazardous Material Properties
- Security Classification

DIRECTIVES
- Directive

FACILITIES
- Facility

FINANCIAL ACCOUNTS
- Cost Account
- Job Order Number

FINANCIAL TRANSACTIONS
- Financial Transaction
- Cash Transaction

INFORMATION PRODUCTS
- Technical Information
- Interoffice Communication

INFORMATION REPOSITORY
- Information Model
- Information System

INSPECTIONS
- Inspection

INVOICES
- Payable Invoice

LEGAL AGREEMENTS
- Legal Agreement

MATERIAL INVENTORIES
- Storeroom Inventory
- Plant Property
- Controlled Material

NAVSWC DELIVERABLES
- NAVSWC Service
- NAVSWC Product

ORGANIZATIONS
- Organization

PEOPLE
- Person

PLANS
- Information Management Plan
- Human Resource Plan
- Program Plan
- Transport Services Plan
- Facility Plan
- Material/Services Mgt. Plan

POSITION DESCRIPTIONS
- Position Description

PROVIDERS
- Provider

PROCUREMENTS
- Procurement Line Item
- Procurement Document

PROGRAMS
- Program

PROPOSALS
- Proposal

SPONSORS
- Sponsor

SPONSOR ORDERS
- Sponsor Order

STRATEGIC PLANS
- Strategic Plan

TASKING ORDERS
- Tasking Order

TASKS
- Task

UTILITIES
- Utility

VIOLATIONS
- Violation

VEHICLES
- Vehicle

Figure 4-5. Entity Type within Data Store Table

STRATEGIC PLANNING
- Develop Organization Vision

POLICY MANAGEMENT
- Develop Organization Direction

PLANNING
- Develop Coordinated Plans
- Determine Manpower Requirements
- Develop Information Guidance
- Develop Program Plan

BUDGET PREPARATION
- Consolidate Budgets

REVIEW & EVALUATION
- Monitor Program
- Analyze & Review Financial Management
- Review Organization Effectiveness

STAFFING & CLASSIFICATION
- Classify Positions
- Recruit Personnel
- Hire Personnel
- Reassign Personnel

PERSONNEL ADMINISTRATION
- Assign Work
- Manage Time & Labor
- Manage Personnel Performance
- Train Personnel
- Provide Personnel Services

RESOURCE ALLOCATION & CONTROL
- Structure Organization
- Request/Authorize Resource Use

CONCEPT DEVELOPMENT
- Assess NAVY Needs
- Assess Technology Trends
- Develop Organization Options

MARKETING
- Develop Proposal
- Market Proposal
- Determine Sponsors

PROGRAM MANAGEMENT
- Create Program
- Execute Program

FUNDING
- Accept & Allocate Funds
- Reconcile & Close Authorizations

ACCOUNTING
- Perform Accounting

CASH MANAGEMENT
- Disburse Payables
- Collect Receivables

ACQUISITION
- Screen Requisitions
- Process Procurements

RECEIPT CONTROL
- Receive & Inspect Material
- Receive & Certify Services
- Deliver Material

MATERIAL MANAGEMENT
- Issue Storeroom Inventory
- Establish Material Controls
- Maintain Material Accountability

INFORMATION RESOURCE MANAGEMENT
- Identify Information Requirements
- Analyze Information Requirements
- Develop Information Policies & Standards
- Develop Information Architecture
- Coordinate Development Projects
- Design Information Sytems
- Implement Information Systems

INFORMATION SERVICES
- Determine Information Availability
- Create Information Product
- Maintain Information
- Distribute Information

FACILITY DESIGN & CONSTRUCTION
- Design Facility/Utility
- Construct Facility

FACILITY OPERATIONS & MAINTENANCE
- Operate Facilities & Utilities
- Maintain Facilities & Utilities

TRANSPORT OPERATIONS
- Screen Transport Requests
- Manage Transport Operations

VEHICLE MAINTENANCE
- Maintain Vehicles

PERSONNEL SAFETY
- Safeguard Personnel

PHYSICAL SECURITY
- Safeguard Material & Equipment
- Safeguard Facilities & Utilities

Figure 4-6. Process within Business Systems Table

Organizational Effectiveness from the Organizational Management function. Sometimes a single business system relates well to the functional decomposition.

All natural business systems, by virtue of the way the methodology defines them, are comprised of processes that create data. These processes, in many cases, are the responsibility of a single organizational unit as shown in Figure 3-4. The data they create will support a wide range of information needs, from low-level transaction processing to high-level strategic decision-making. Business systems must create data to support all these categories. In planning for information systems to support NSWCDD, we determine the categories of information needs for which business systems will need to provide supporting data.

4.3.3 Business Areas

Business areas are simply collections of entity types and processes that should be analyzed together in greater detail. We identified business areas by bringing together the natural data stores and natural business systems defined by the clustering process. Appendix C contains a CRUD matrix whose rows and columns have been re-ordered to reflect the clustering of natural data stores and business systems. Business areas are indicated in this matrix as the bold line boxes. These groupings of entity types and processes define the boundaries of the BAA projects to be undertaken in the next phase of the methodology. The NSWCDD ISP project identified 10 business areas. Figure 4-7 presents these business areas and the business systems falling in each area. Remember that the analysis projects will use these processes as a starting point and will add considerable detail to the process decomposition.

Figure 4-8 presents four categories of information use (transactional, monitoring and control, planning and analysis, and strategic). It maps the business systems, grouped by the business area they support, onto these categories. As the figure indicates, none of the systems are solely transactional in nature. They all will support information needs beyond the transactional level and will, therefore, provide data to broad segments of NSWCDD.

A representation of the business systems architecture is presented in Figure 4-9. Each of the 10 business areas is shown in a format that indicates the scope of the business area's involvement with data. The figure can be thought of as a pictorial representation of the CRUD matrix in that it differentiates between primary interactions (creates) and secondary interactions (updates and reads). Within each business area diagram, the expected business systems are shown in a box color coded for that business area.

Within each business area diagram, we also show data stores. A data store is composed of one or more entity types, as shown in Figure 4-5 above. We have spatially organized the data stores based on where the data store is created and how the business area uses the data; i.e., creates or reads the data. We have divided the data stores into three groups: (1) created by the business area, (2) created by another business area and updated by the business area, and (3) read by the business area. The first group is to the left of the colored box, under the heading

CORPORATE POLICY & DIRECTION	**SAFETY & SECURITY**
STRATEGIC PLANNING	PERSONNEL SAFETY
POLICY MANAGEMENT	PHYSICAL SECURITY
ORGANIZATION MANAGEMENT	**PLANNING & REVIEW**
STAFFING & CLASSIFICATION	PLANNING
PERSONNEL ADMINISTRATION	BUDGET PREPARATION
RESOURCE ALLOCATION & CONTROL	REVIEW & EVALUATION
FINANCIAL MANAGEMENT	**PRODUCT DEVELOPMENT**
FUNDING	CONCEPT DEVELOPMENT
CASH MANAGEMENT	MARKETING
ACCOUNTING	PROGRAM MANAGEMENT
FACILITY MANAGEMENT	**ACQUISITION & MATERIAL MANAGEMENT**
FACILITY DESIGN & CONSTRUCTION	ACQUISITION
FACILITY OPERATIONS & MAINTENANCE	RECEIPT CONTROL
	MATERIAL MANAGEMENT
TRANSPORT MANAGEMENT	**INFORMATION MANAGEMENT**
TRANSPORT OPERATIONS	INFORMATION RESOURCE MANAGEMENT
VEHICLE MAINTENANCE	INFORMATION SERVICES

Figure 4-7. Business Systems within Business Areas Table

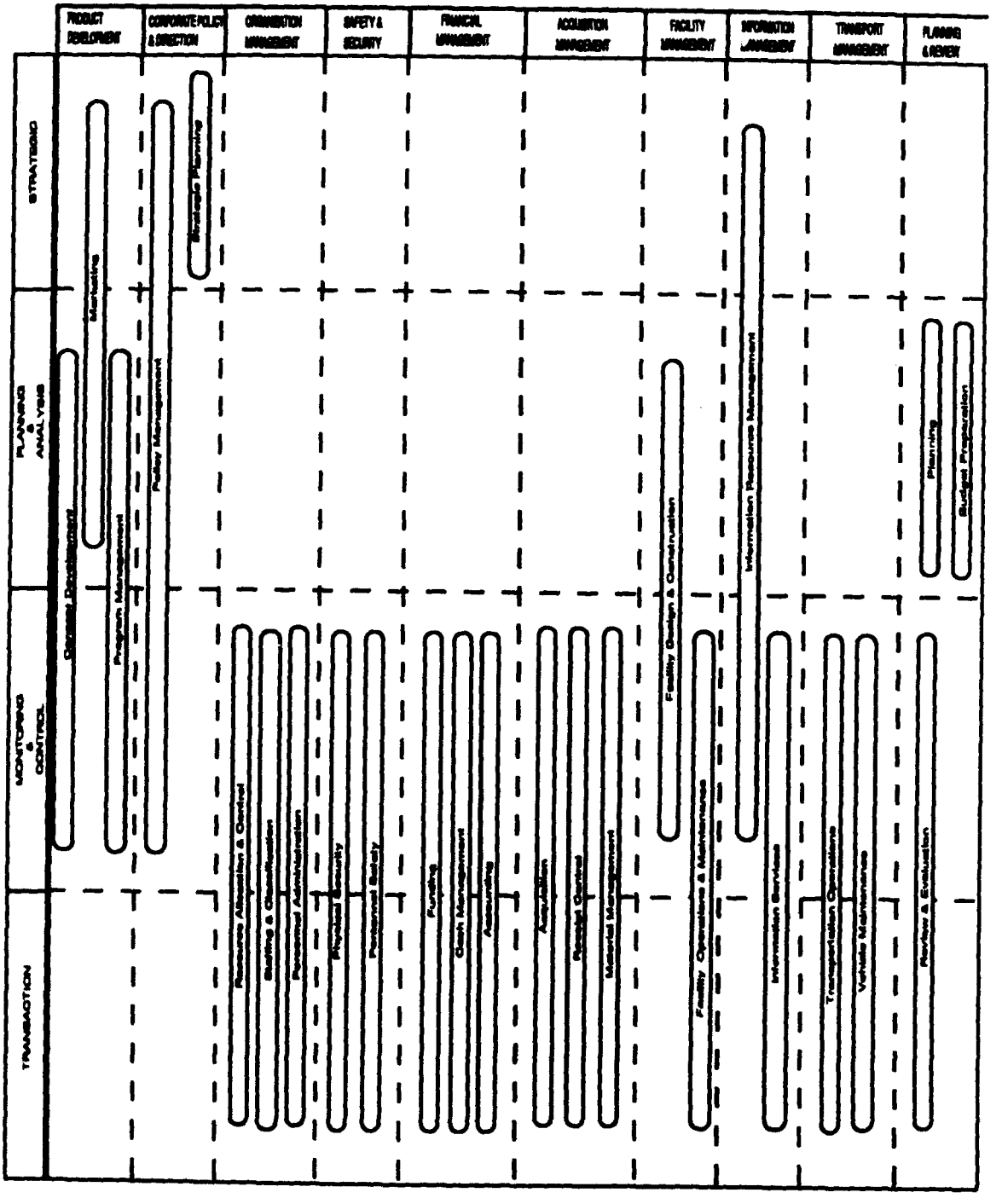


Figure 4-8. Business Systems and Categories of System Use

"Primary Interactions." These data stores fall within the bounds of the business area. In other words, these are the data stores that are created within the business area. These data stores are the same color as the business systems box to indicate their close affiliation with these systems.

The second group is to the right of the shaded box. These data stores are created within some other business area, but are updated by functions within the business area being considered. The business area that creates a particular data store can be identified by locating the data store in the "Primary Interactions" section of some business area diagram. The color coding simplifies this search. For example, to find the business area that creates the data store **Organizations** (colored light blue) simply look through the business area diagrams and find the business system box of the same color. This reveals the data store **Organizations** listed as a primary interaction under the business area **ORGANIZATION MANAGEMENT**.

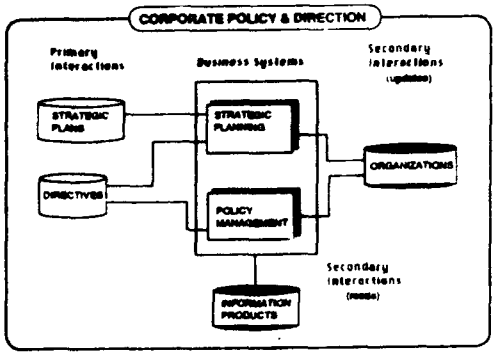
The third group is below the colored business systems box. These are all the data stores from which the business area needs to read data. Occurrences of secondary interactions -- groups two and three -- indicate requirements to share data between business areas. This figure is a graphic illustration of why developing systems in an applications paradigm will not suffice in our environment. The data stores need to be independent of individual applications of the business areas and they need to be controlled. We must support these needs to efficiently and effectively maintain systems, especially in an environment of mandated systems.

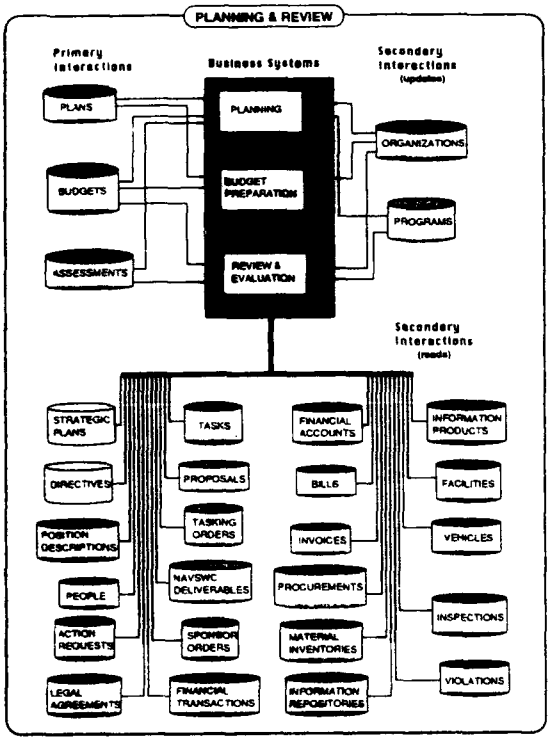
Although the diagrams in Figure 4-9 indicate information dependencies between business areas, more detail is needed to understand the actual interplay between business systems and data stores. The data flow diagrams provide this detail as shown in Appendix D. In Appendix D, each business system is presented as a data flow diagram, which displays the processes that make up the system and the flow of data between processes. The diagram shows data flows to and from other business systems, as well as to and from agents outside the enterprise.

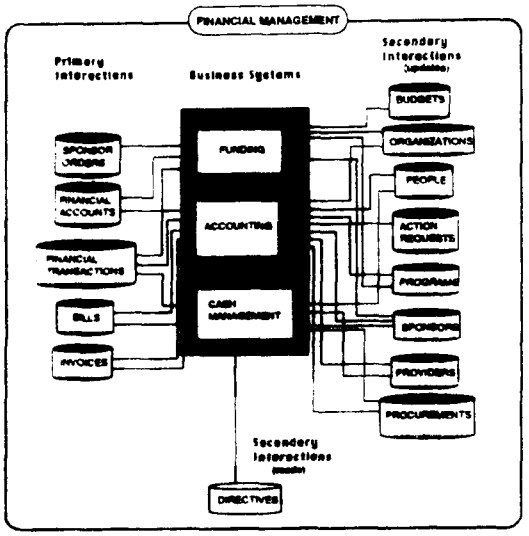
4.4 Business Area Support for Information Needs

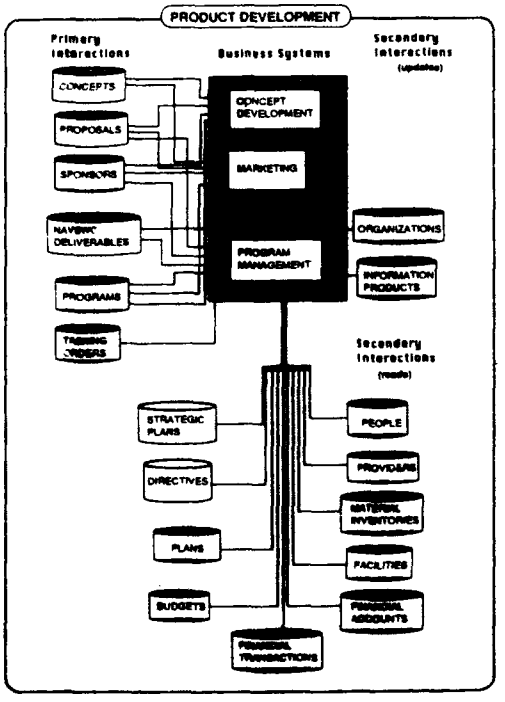
Constraints on people, money, and time prevent detailed analysis of all 10 business areas at once, so a priority for analysis projects must be established. Chapter 7 deals with the Information Strategy and will identify the priority projects. This section will lay some of the foundation for the strategy by considering the business areas from an *information needs* point of view. This assessment will then become one of the evaluation criteria used to formulate the Information Strategy.

Ideally, business areas should be ranked according to their support for the critical success factors of the enterprise. In the absence of formal critical success factors for NSWCDD, the ISP project teams identified a set of information needs that might be considered critical to Center operations. Identifying critical needs is no trivial task given the volume of requirements documented during ISP. In fact, through interviews with clients, reference team workshops,









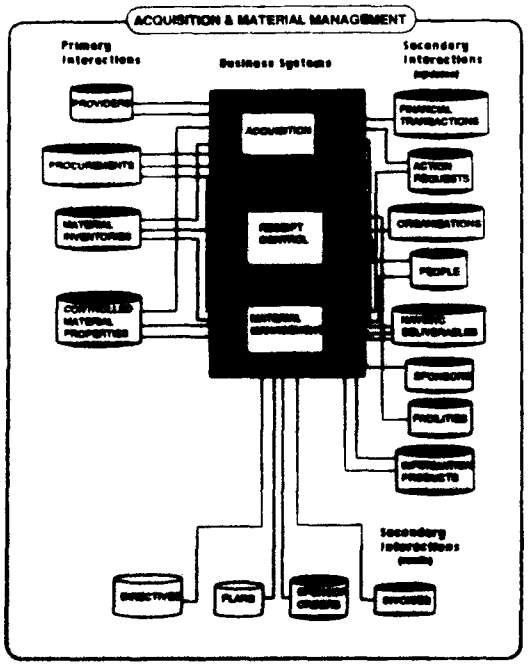
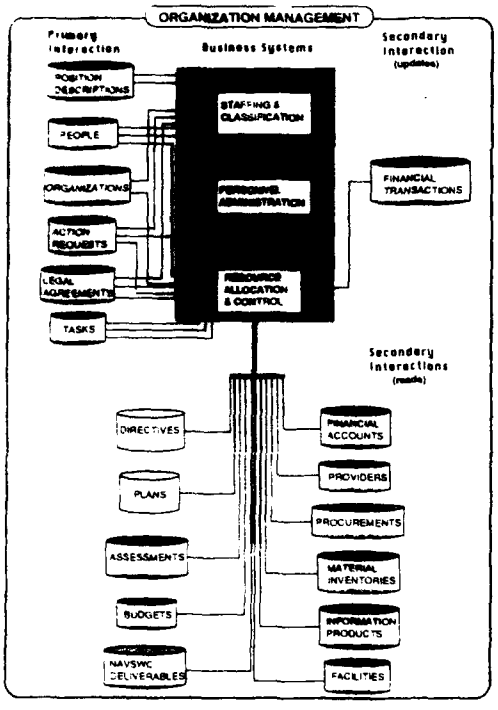
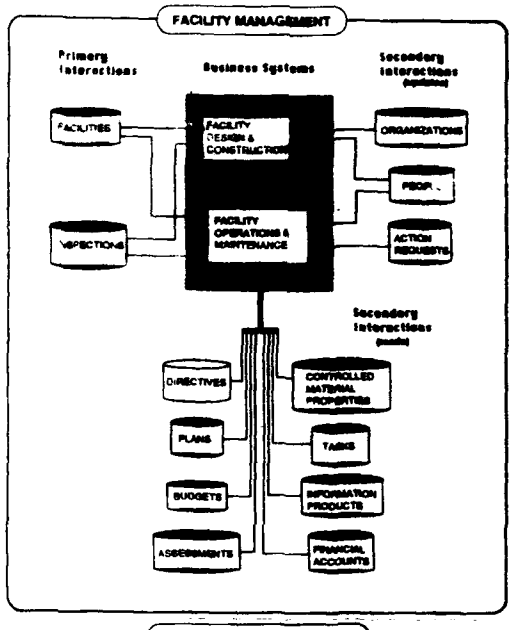
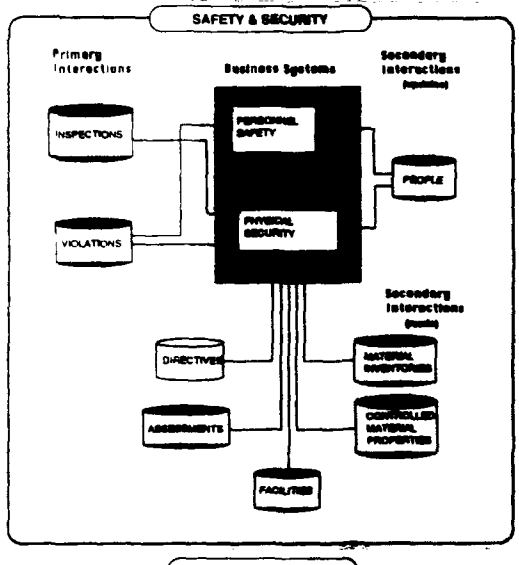
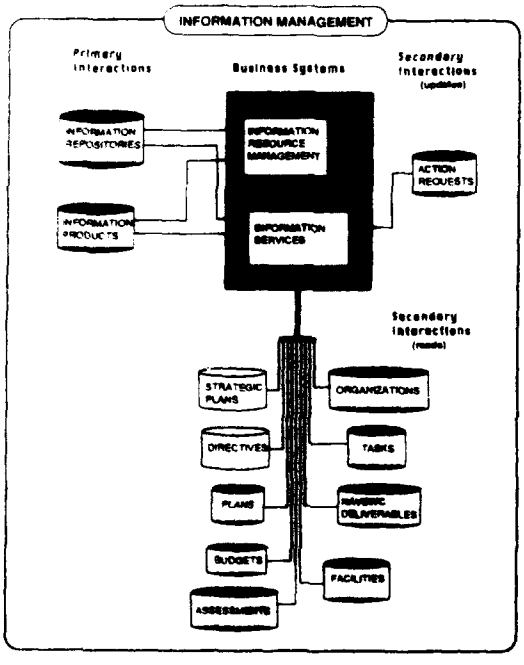


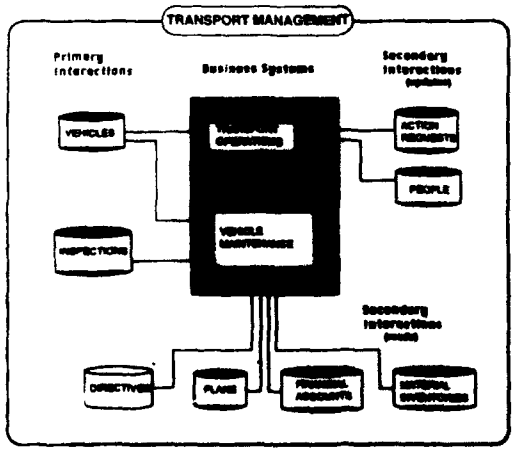
Figure 4-9. Business Systems Arch


ORGANIZATION MANAGEMENT
Primary Interaction
Business Systems
Secondary Interaction (updates)
POSITION DESCRIPTIONS
PEOPLE
ORGANIZATIONS
ACTION REQUESTS
LEGAL AGREEMENTS
TASKS
STAFFING & CLASSIFICATION
PERSONNEL ADMINISTRATION
RESOURCE ALLOCATION & CONTROL
FINANCIAL TRANSACTIONS
Secondary Interactions (reads)
DIRECTIVES
PLANS
ASSESSMENTS
BUDGETS
NAVSWC DELIVERABLES
FINANCIAL ACCOUNTS
PROVIDERS
PROCUREMENTS
MATERIAL INVENTORIES
INFORMATION PRODUCTS
FACILITIES


FACILITY MANAGEMENT
Primary Interactions
Business Systems
Secondary Interactions
FACILITIES
INSPECTIONS
FACILITY DESIGN & CONSTRUCTION
FACILITY OPERATIONS & MAINTENANCE
ORGANIZATIONS
PEOPLE
ACTION REQUESTS
Secondary Interactions (reads)
DIRECTIVES
PLANS
BUDGETS
ASSESSMENTS
CONTROLLED MATERIAL PROPERTIES
TASKS
INFORMATION PRODUCTS
FINANCIAL ACCOUNTS


SAFETY & SECURITY
Primary Interactions
Business Systems
Secondary Interactions
INSPECTIONS
VIOLATIONS
PERSONNEL SAFETY
PHYSICAL SECURITY
PEOPLE
Secondary Interactions (reads)
DIRECTIVES
ASSESSMENTS
MATERIAL INVENTORIES
CONTROLLED MATERIAL PROPERTIES
FACILITIES


INFORMATION MANAGEMENT
Primary Interactions
Business Systems
Secondary Interactions (updates)
INFORMATION REPOSITORIES
INFORMATION PRODUCTS
INFORMATION RESOURCE MANAGEMENT
INFORMATION SERVICES
ACTION REQUESTS
Secondary Interactions (reads)
STRATEGIC PLANS
DIRECTIVES
PLANS
BUDGETS
ASSESSMENTS
ORGANIZATIONS
TASKS
NAVSWC DELIVERABLES
FACILITIES


TRANSPORT MANAGEMENT
Primary Interactions
Business Systems
Secondary Interactions
VEHICLES
INSPECTIONS
VEHICLE MAINTENANCE
ACTION REQUESTS
PEOPLE
Secondary Interactions (reads)
DIRECTIVES
PLANS

and analysis of existing documentation over 600 information needs were identified. Appendix E gives the list of source documentation used. By abstracting, summarizing, and eliminating redundancies, 87 information needs were selected to assist in the ranking of BAA projects.

The histogram in Figure 4-10 shows the number of information needs addressed by each business area. As indicated by the histogram, the largest information needs are addressed by three business areas: Organization Management, Financial Management, and Acquisition and Material Management. The histogram information was derived from the matrices in Figure 4-11 on the following pages. These matrices relate the individual information needs to the business areas that address them. The information needs in the rows of the matrix have been arranged to group needs by business area to aid readability and understanding. No attempt has been made to identify the most important information needs and no order of importance is implied by the order of the rows. The diagrams in Figure 4-9 show the great overlap in data store usage by the business areas. Hence, the development of any of these three primary business areas will probably require at least some preliminary definition and development of data stores outside the business area, particularly from the Product Development business area.

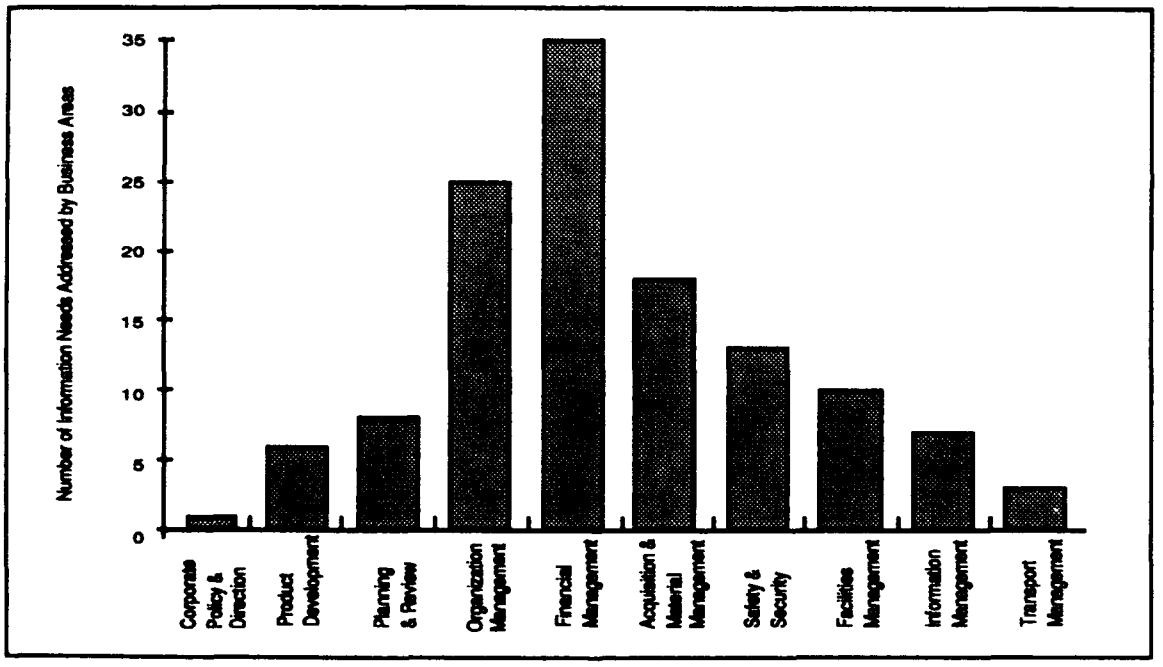


Figure 4-10. Business Area Support for Information Needs

	Corporate Policy and Direction	Planning and Review	Organization Management	Product Development	Financial Management	Acquisition & Material Management	Information Management	Facilities Management	Transport Management	Safety and Security
Policies, directives, procedures	X									
Audit findings		X								
Integrated program/project/department plans		X	X	X						
Regulation compliance		X								
Workforce data		X	X							
Budget data		X		X						
Training data			X							
Military support statistics			X							
Employee awards			X							
Job descriptions			X							
Performance standards			X							
Personnel actions			X							
Recruiting data			X							
Performance data			X							
Performance evaluations		X	X							
Total personnel on board			X							
Total S&Es			X							
Average grade of workforce			X							
Age of workforce			X							
Personnel retention metrics			X							
EEO profile of workforce			X							
Time and attendance data			X		X					
MTP allocations		X	X		X					
Travel orders and claims			X		X				X	
MTP expenditures			X		X					
Program Status		X		X	X	X				
Workload and funding summaries by appropriation			X	X	X					
Patent applications and issuances				X						
Direct work percentage				X	X					
Quantification of NAVSWC work				X	X					
Plant value					X					
Bad charges					X					
MWR funding					X					
New orders (Reimbursable and RCP)					X					
Stabilized billing rate					X					
Carryover dollars					X					
Overhead expenditures					X					
Customer billing					X					
Labor cost					X					
MJO/AJO status					X					

Figure 4-11. Information Needs to Business Areas

	Corporate Policy and Direction	Planning and Review	Organization Management	Product Development	Financial Management	Acquisition & Material Management	Information Management	Facilities Management	Transport Management	Safety and Security
Service cost centers status					X					
Environmental expenditures					X					X
Plant maintenance expenditures					X			X		
Equipment maintenance expenditures					X	X				
Total procurement dollars					X	X				
CPP execution statistics					X	X				
CPP acquisition costs					X	X				
Equipment lifespan					X	X				
Total inventory purchase value					X	X				
Material and services cost data					X	X				
MLSR purchase values					X	X				X
Small business contracts						X				
ServMart not-in-stock rates						X				
Procurement competition metrics						X				
Procurement administrative lead time						X				
Equipment disposal times						X				
Contract status						X				
Material and supply inventories						X				
Requisition and stub status						X	X			
Action mail							X			
Naval messages							X			
Internal mail delivery times							X			
Number of technical publications							X			
Controlled material status							X			X
Classified document inventory							X			X
OP 98 total for all R&D centers					X			X		
Energy consumption								X		
Facility space allocation and utilization								X		
Age and condition of facilities								X		
Facility work requests								X		
MILCON projects								X		
Inspection details								X	X	X
Transportation requests									X	
Physical security Backlog ($ value)					X					X
Employee clearances			X							X
Visitor clearances										X
On the job injuries										X
Security violation details										X
Number of lost time cases and days			X							X
Hazardous waste metrics										X

Figure 4-11. Information Needs to Business Areas (Continued)

CHAPTER 5

TECHNICAL ARCHITECTURE

The Technical Architecture is the last major piece of the puzzle. It describes the mixture of hardware, software, and communications facilities needed to support the other architectures: Information and Business Systems. At the ISP phase of the program, the Technical Architecture identifies appropriate technical components, which make up the building blocks. It does not specify actual products. The objectives of this part of the planning are to:

a. provide an overview of available technical components and policies
b. identify technology trends that are relevant to NSWCDD

The analysis encompasses all hardware and software facilities used for information processing and all communications facilities used for transmission of information, except the telephone and naval messages facilities.

5.1 Current Technical Environment

The technical environment currently in place at NSWCDD consists of a wide range of hardware and software components supplied by a number of vendors. Anchored by the Control Data Corporation (CDC) mainframes, the environment includes VAX/VMS systems, various UNIX-based minicomputers, workstations, terminals, personal computers -- both MS-DOS and Macintosh. NSWCDD is supported by several communications networks, including NSWCDD Wide Area Network (CWAN) for terminal to host connectivity, and NSWCNET, a host-to-host network based on the DOD standard Internet Protocols. In addition, to the centrally managed networks, several work groups have installed Local Area Networks (LANs) for their personal computers and workstations, and some programs have tied together their VAX/VMS complexes.

During the ISP, NSWCDD was physically distributed among the principal sites at Dahlgren, Virginia, and White Oak, Maryland, and four remote sites at Wallops Island, Virginia; Brighton Dam, Maryland; Ft. Monroe, Virginia; and Ft. Lauderdale, Florida. Figure 5-1 highlights these locations and indicates the centrally controlled technical facilities at each site.

Figure 5-2 represents NSWCDD's current technical environment in a format that groups technical facilities -- hardware, software, and communication networks -- according to the information technology areas they serve and the degree to which they are shared. Four technology areas are pertinent to NSWCDD:

a. Business Transaction Processing
b. Management Information Services
c. S&E Computing
d. Office Automation

By looking vertically along any of these technology area columns, one can determine the kinds of technical facilities supporting that area. Business transaction processing refers to systems that process detail data; e.g., the financial management system processing accounts payable records or payroll records. The management information services area will use much of the same data as the transaction systems, but will be interested in it after the detail data has been processed; e.g., funds expended to date for a program. It would also have data not necessarily processed by a business transaction system; e.g., milestone data. The Scientific and Engineering (S&E) computing area encompasses the processing done in support of the real business of NSWCDD. Office automation refers to the tools at the desktop available to each employee for the carrying out of their work. The tools required would vary by the employee and would depend upon the function each performs or is performing at the time. For example, word processing tools are needed by many employees, whether they work in the technical, managerial, or support areas. Different data reduction tools might be more applicable to engineers or administrative officers. Office automation also covers electronic mail and other server areas.

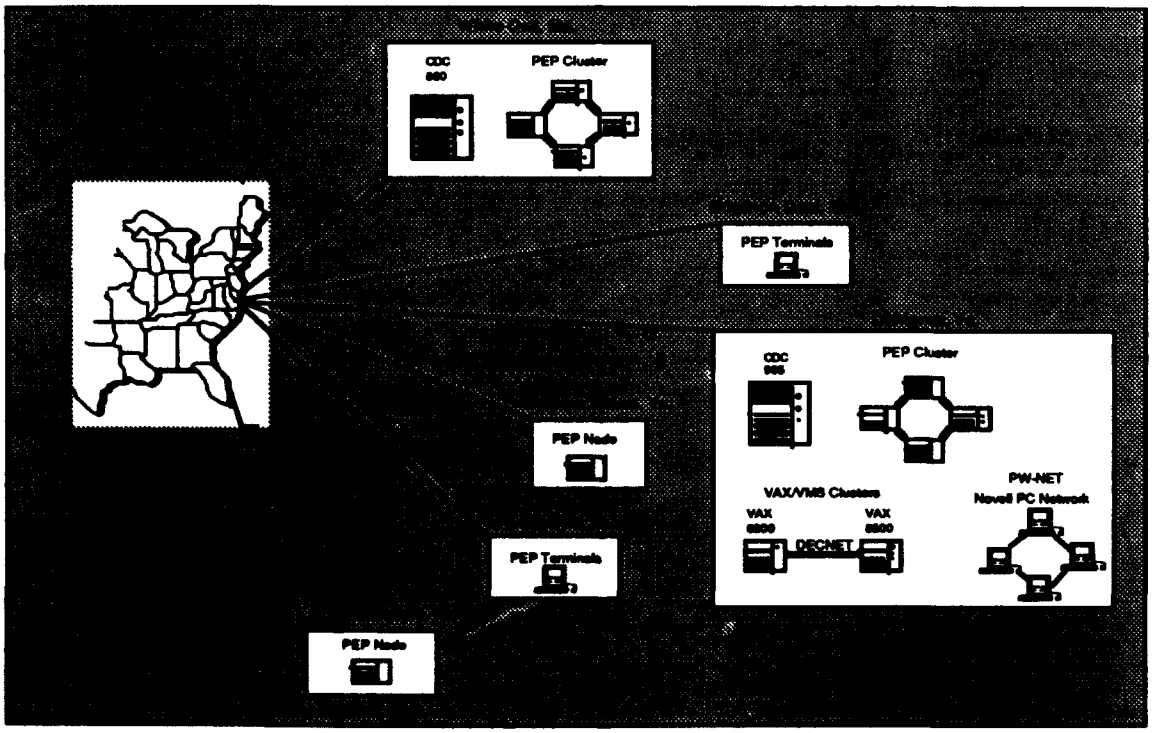


Figure 5-1. Locations of NSWCDD Technical Facilities

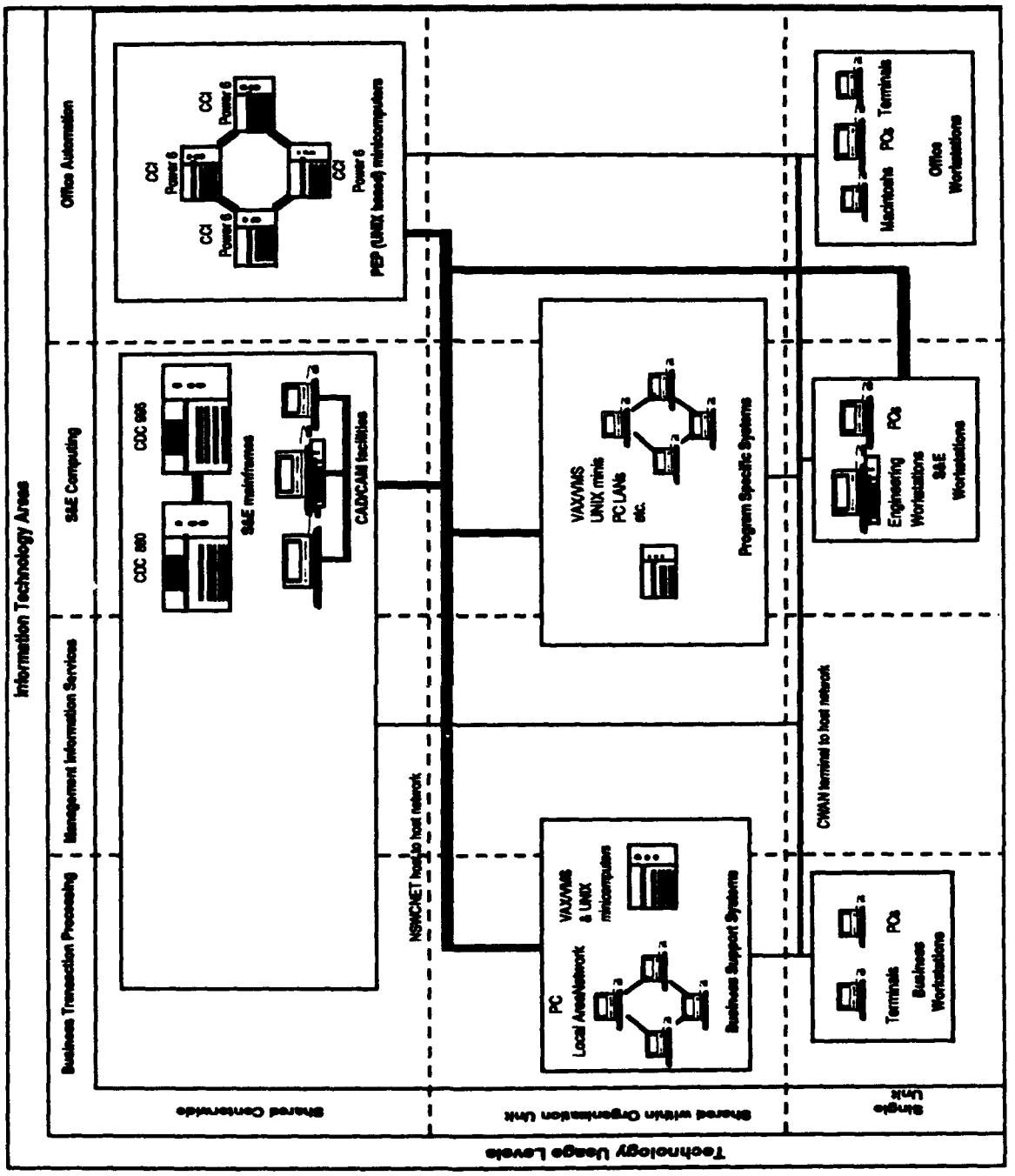


Figure 5-2. Current Technical Architecture

Technical facilities are grouped within the columns according to the typical usage level of the technology. For example, S&E mainframes are shared across NSWCDD, but a particular personal computer is usually used as an unshared component. One of the challenges of the NSWCDD environment occurs at the Single Unit level. In the diagram, it would appear that there are separate workstations for business, S&E, and office automation. But, many clients work in all areas and the need exists for each client to have only one device on his/her desk. These same devices must also be able to tie into the higher levels of technology usage; e.g., the workstation as a terminal to the higher S&E computing powers. The current installed base and the need for diversity of systems and workstations require a technologically challenging solution. This presentation of technical architecture helps the designer make decisions about the kinds of technology to apply to the requirements that are inherent (and sometimes unique) to each information technology area.

A brief explanation of the contents of Figure 5-2 will help us to understand why certain components appear where they do. The large box that appears in the "Shared Division-wide" row contains the S&E mainframes and the networked workstations and personal computers. These components represent the central S&E computing facility and the CAD/CAM facility. Currently, the CDC mainframes are allocated to much more than S&E computing, which is shown by the box spread into other technology areas. Business processing traditionally has been supported on the S&E computing systems, and currently the Financial Management System, Accounts Payable, Civilian Payroll, Plant Account system, and many other business applications are run on the mainframes. NSWCDD's Office Automation systems consists of a cluster of UNIX-based minicomputers that are accessed either by terminals or by personal computers and workstations running terminal emulation software.

In the "Shared within Organization Unit" row, the box labelled "Business Support Systems" represents the systems that support transaction and MIS-level processing within NSWCDD's support departments. Examples of these systems are the Automated Inventory Control System (AICS) for the Supply Department and the CHRIS for the Personnel Department. Program Specific Platforms represent systems whose primary purpose is to support special requirements of technical programs. For example, AEGIS, Tomahawk, and VLS programs have such systems. These systems now manually or semi-automatically import some data from the financial systems operated for the Comptroller Department.

Finally, in the "Single Unit" row are the devices found on the end-user's desktop. Terminals, IBM-compatible personal computers, ranging in power from the original personal computers to high end 80486-based machines, Macintosh systems, and a variety of engineering workstations comprise this component of the environment.

Although secure facilities are not explicitly identified in Figure 5-2, much of NSWCDD's processing is classified. The CDC 875 computer is dedicated to classified processing and is accessed via the secure terminal to host SENET network. Most of the program specific systems are also used for processing classified information. The lack of capability to share information more easily between classified systems and between systems that are predominantly classified but need to import unclassified information to produce final products is a large drawback to the current environment.

Overall, NSWCDD's current technical environment can be characterized as decentralized. There is no single, central computer system that handles all processing requirements. There is little adherence to standards for interoperability. Instead, an environment has evolved in which many host computer platforms exist and in which most processing occurs in terminal to host mode. Although personal computers are prevalent, they have not been well integrated into the mainstream processing operations and their computing power has been under utilized.

5.2 Defining a New Technical Environment

Up to this point, two of the three objectives of ISP have been addressed. High-level information requirements of NSWCDD have been identified, and a view of the systems needed to provide the information has been established. The third and final objective is to identify the kinds of technologies that might be utilized to implement the systems. NAVSEA has defined a top-level technical architecture[3] to which it plans to migrate over the next several years. As a part of the NAVSEA organization, NSWCDD will need to conform to those guidelines. The guidelines present a direction that meshes with the conclusions of this analysis.

Like NAVSEA, NSWCDD requires information technology solutions that provide for interoperability of products across heterogeneous systems, portability of software, data distributed across multiple locations, and systems that can be scaled depending upon location. NSWCDD has a sizeable investment in hardware, and we would like to re-use existing hardware where possible. Sizing and performance tests performed would seem to indicate that some of our existing suite of hardware is not as capable as we would like for a database environment. The Technical Architecture will satisfy the following objectives:

a. Adopt and implement open systems standards

b. Provide the most effective means of managing the application of information systems technology to the needs of NSWCDD

c. Achieve seamless and transparent sharing of data and applications across sites

d. Provide for the use of common definitions of data needed to meet NSWCDD information needs, which are consistent with higher echelon requirements

e. Achieve interoperability of all applications platforms

f. Ensure portability and scalability of applications and infrastructure software in a multivendor environment

g. Implement the technical infrastructure necessary to achieve the business and IRM goals of NSWCDD within constraints placed on NSWCDD

Some of these objectives are beyond the current state-of-the-art in information technology. They will, nonetheless, be the basis on which decisions will be made concerning the care and

feeding of the technical architecture. Since standards to support the achievement of these objectives are not fully implemented, a transition strategy will be needed.

Several technical and philosophical trends are developing within the realm of information management that should be considered in the definition of a new technical environment. Some of these are presented below.

Open Systems Architecture. To break the stranglehold of proprietary vendor solutions, the Government has begun adopting standards for an open systems environment that ensures interoperability and applications portability across multivendor platforms. The Government Open Systems Interconnection Profile (GOSIP) became a mandatory specification for Government computer and communications procurements in 1990. GOSIP is a set of data communications standards.

Relational Database Management. This technology is mature, well supported by vendors, and is capable of satisfying the performance requirements of transaction-oriented systems as well as Management Information Systems (MIS) applications. Relational database technology will likely be the defacto data management standard for at least the next decade. The capability of distributed data management is slowly being added to some relational database systems. The performance problems of distributed Relational Database Management Systems (RDBMS) are significant in a technical sense. But, the payoff in the maintenance of the databases themselves could be large in our geographically distributed environment.

Computer Aided Systems Engineering (CASE). CASE tools are now available that can automate the process of engineering software systems. Information pertinent to the life cycle of the systems can be contained in CASE tools. Details range from requirements, to design specifications, to implementation details. Automatic code generation from system specifications promises to reduce development time, produce higher quality systems, and lower software maintenance costs. CASE will be connected to a repository environment, which will change the processes for configuration management and quality assurance.

Electronic Data Interchange (EDI). Based on the X.400 messaging standard, this technology provides a means to electronically transfer procurement data between buyer and supplier. EDI is a proven cost saver in private industry and is beginning to take hold in the Government sector. The goal of the CALS effort is an expansion of EDI and covers more than messaging standards; e.g., document and graphical representation standards.

Graphical User Interfaces (GUIs). GUIs such as that found on the Macintosh personal computer are an emerging technology, which makes systems easier to use than the traditional text-based user interface. GUIs take advantage of the cognitive ability of people to recognize and understand graphic symbols faster than they can derive meaning from text. GUIs are becoming more feasible as the power of personal computers increases.

Multiprocessor computers. Computer vendors have recognized the need for flexible hardware configurations that can grow in capability as the customer's requirements change. Multiprocessor platforms that can be configured to the particular performance requirements and budget of the customer. They provide scalability of applications.

Imaging Systems. Technical advances in scanner devices and large volume storage devices; e.g. optical disks, have made image processing a feasible technology in the management of documentation. Such technology could be very beneficial in managing information such as personnel records and official mail and messages.

Downsizing. An emerging trend in the information industry is downsizing. It strives to offload applications from the mainframe and allocate them to smaller machines, which offer significantly better price/performance ratios.

Distributed Computing. The essence of distributed computing is the allocation of parts of an application to more than one computer. Each computer performs a certain set of functions and is tuned to optimize the performance of those functions. The use of multiple computers is made transparent to the end-user through the use of technologies such as remote procedure calls (RPCs). Several vendors currently offer implementations of distributed computing based on the client/server architecture.

Object Oriented Software. Software developed for objective oriented software tools; e.g., Ada, can often be developed more rapidly than software developed in standard procedural languages. Two large factors are reusability of code and the embedding of business rules with the objects. There are definite trends in this direction with languages and databases being developed to support this concept. In the private sector, the financial industry is moving in this direction, which is a surprise from a normally conservative industry.

5.3 Technical Architecture

NAVSEA defined an architectural structure[3] for use throughout its command. We will follow their guidance. The model is based on the Information Systems Conceptual Model defined by the Open Systems Environment (OSE) Reference Model and the Applications Portability Profile (APP) developed by NIST. They also used the Navy Communications Control Architecture (Draft) and the Navy CALS Architecture promulgated by OPNAV. By following this guidance, we will be in synchronization with other Government and Navy efforts.

The model is presented in conceptual layers in Figure 5-3. This is a variation of the NAVSEA model. The following sections describing the model are taken directly from the NAVSEA IRM Plan.

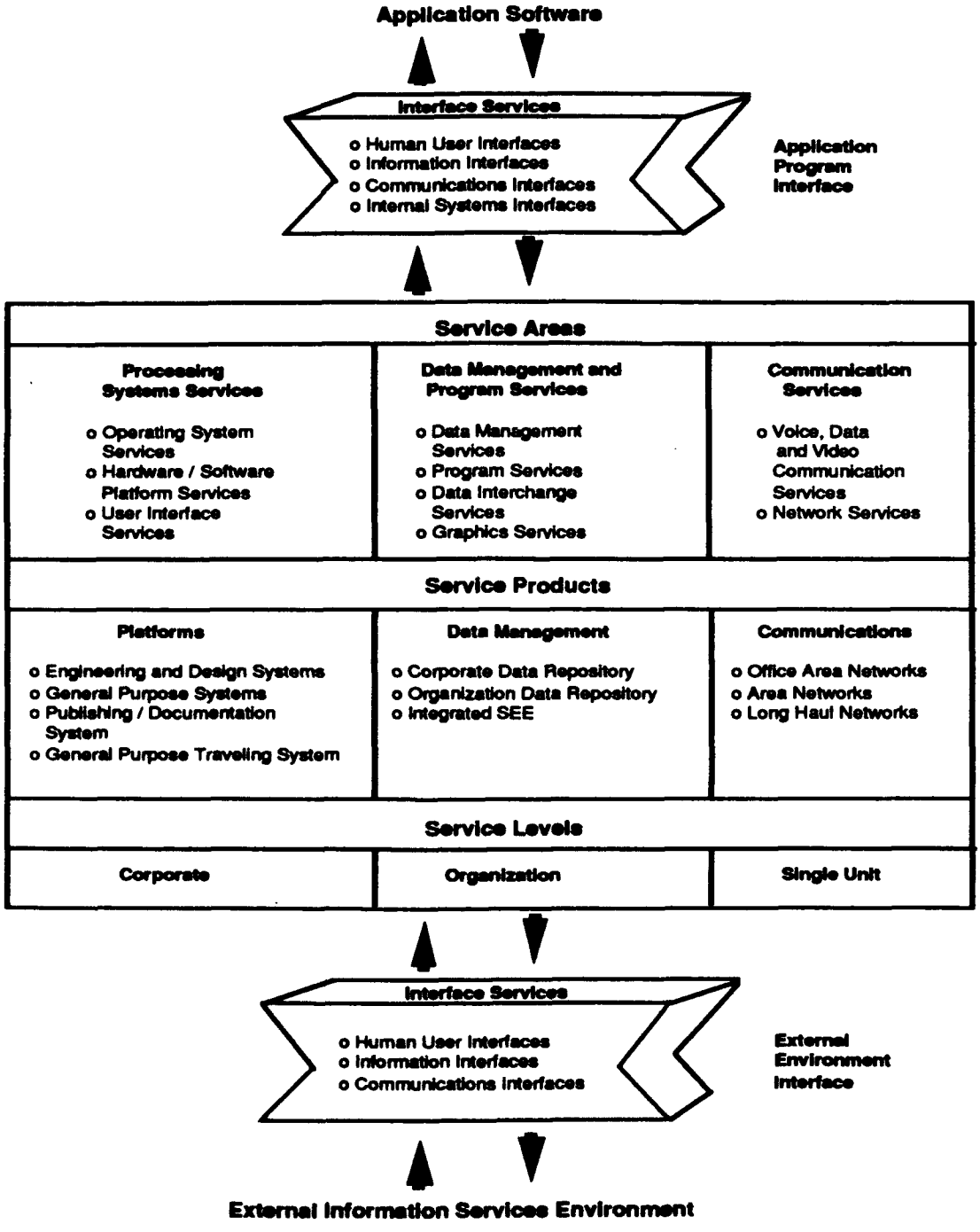


Figure 5-3. NAVSEA Technical Architecture Model

A layered approach was taken in establishing the model in order that the layers could be addressed independently and with minimal impact on each other. The five layers of the architecture are:

a. Application Software
b. Application Program Interface
c. Information Services Environment
d. External Environment Interface
e. External Information Services Environment

The first layer in the model is the Applications Software layer. This layer includes programs, data and documentation to support the information needs of NSWCDD. The major effort of the NICCS program will lie in this area as the Business Areas are analyzed and systems either built or procured to support the functional and data needs of NSWCDD.

The Application Program Interface (API) is intended to make specific characteristics of the Information Services Environment (ISE) transparent to the application software. The relationship between the Application Software layer and the Information Services Environment through the API is demonstrated conceptually in Figure 5-3.

The ISE includes the collection of hardware, software, services, and facilities that support the applications software. ISE will facilitate portability through services accessed by the API. The ISE includes three dimensions: (1) Major Services Areas, Service Levels, and Service Products. The Major Service Areas can be further divided into Processing Systems Services, Communications Services, and Data Management and Program Services. The Processing Systems Services includes the hardware, software, and facilities to operate and administer the information services of NSWCDD. The second dimension of ISE is Service Levels and Service Products. The ISE is directed at three levels of usage: Single Unit, Shared within Organizational Unit, and Shared Division-wide. Service Levels refer to the client base to which the service is being directed, not to the number of people using the service, nor to a size or type of hardware platform. The term "Organizational Unit" refers not only to the traditional line organizations but any other grouping; e.g., program or project. In the model, categories of service products have been identified, which will be to deliver the services to the client base. The categories are Platforms, Data Management, and Communications. These categories support the capability, performance, and capacity needs of an information system; share applications and data within and among service levels; and provide a uniform user interface that reflects a high degree of human engineering. These products will be provided across all three information service levels and will be the delivery mechanisms for the service areas identified in the model.

The External Environment Interface (EEI) will facilitate interoperability between ISE and the External Information Services Environment. The EEI makes the specific characteristics of the two levels transparent to each other.

The External Information Services Environment consists of those system's elements and technologies that are external to NSWCDD. These are services outside the management and

Processing Systems Services	Interim	Target	National Stds
Application Host / Server OS	UNIX / POSIX	POSIX	FIPS 151
Workstation OS	DOS, UNIX / OS2	POSIX	FIPS 151
Shared Files	NFS, SMB	TFA, FTAM	CCITT P1003.8
User Presentation	Windows, MOTIF, PRS, MGR, XVT	XWindows	FIPS 158
OS Security	Vendor compliant C2	SIPOSI	IEEE P1003.6
Data Management and Prog Service	**Interim**	**Target**	**National Stds**
Relational DB	Relational Data Model	RDB Model	
DB Definition	SQL-Level 1	SQL	FIPS 127
DB Query Language	SQL-Level 1	SQL	FIPS 156
Data Dictionary	tbd	IRDS	
Interpersonal Messages	ASCII	ASCII	
Message Exchange	SMTP	X.400	
Office Documents	ODA / ODIF	ODA / ODIF	MIL-STD 28002
Business Graphics	CGM / MIL-R-RASTER	X.400	
Engineering Graphics	IGES / MIL-1840	ISO / STEP	
Electronic Forms	EDI	EDI	
Mixed Text and Graphics	SGML / STEP / IGES	SGML / STEP / IGES	ANSI X3.159
Programming Languages	C, Ada	C, Ada	
Communications Services	**Interim**	**Target**	**National Stds**
Network Management	SNMP	GNMP	FIPS (1992)
Internetting	DoD Suite	GOSIP	FIPS 146
Subnetting	DoD Subnet	ES / IS & GOSIP	ISO 9542
Office Nets	DoD, SMG & GOSIP, NFS	TFA & GOSIP	IEEE P1003.8
Area Nets	FDDI, DoD	GOSIP	FIPS 146
Long Haul Nets	DoD (DDN), NAVNET, Private	GOSIP	FIPS 146

Figure 5-4. NAVSEA Open Systems Standards

organizational purview of NSWCDD, but which are either to provide needed external information or are mandated for use.

We will support the open systems concepts promulgated by the NIST and the emerging DoD standards. In the latter case, standards include repositories, CASE tools, CALS, and others. The Applications Portability Profile, developed by NIST, is updated to reflect emerging standards in the areas of the profile. NAVSEA presented a suite of interim and target standards,[3] which are shown in Figure 5-4. Migration to these standards must be based on both cost effectiveness and technological advances.

With an understanding of the current technical environment, trends within the industry, and the kinds of technology the systems will require, a vision of the future technical architecture can take shape. Some components of the current technical environment have well-defined transition strategies already in place; e.g. S&E computing under E40 auspices. These will be presented in the following discussion relative to the major technology directions envisioned for NSWCDD.

5.3.1 Direction for Business Transaction Processing

Business Transaction Processing is moving toward a distributed On-Line Transaction Processing (OLTP) environment. Division-wide accessible components will be available for applications with widespread utilization requirements and locally shared components will address the needs of support organizations. Systems will be based on the Open Systems standards for interoperability and might be implemented as PC LANs, minicomputer clusters, database client/server configurations, or perhaps mainframe platforms, depending on the technical requirements and constraints on funding.

SQL (Structured Query Language) will be employed to manipulate relational databases. Ada is mandated for new business applications by both CIM and the DoN. DoD has developed an interface between Ada and a relational database management system. Business systems development will be supported by Integrated Computer Aided Systems Engineering (I-CASE) tools working in conjunction with an automated information repository. DoD has developed an interface to a CASE tool that will generate Ada code. Neither of the two DoD developed packages are available for general use, but some version will probably become available to meet the needs of DoD in this area.

5.3.2 Direction for Management Information Services

MIS will transition to an environment of distributed relational database and image processing systems supported by centralized corporate database facilities. Executive level information, rolled up from the operational databases, will be available in the MIS environment. Natural language query capability and presentation graphics will be employed in this area. It is anticipated that platforms designed especially for database processing; i.e., database machines, will be used.

5.3.3 Direction for S&E Computing

The technical transition strategy proposed by this plan is predicated on the concept of off-loading Business Transaction Processing and MIS functions from the S&E mainframes and allocating them to technical facilities better suited to the requirements. This should better serve both the business client and the S&E client in the long run. The future of S&E computing, as defined by the Follow On Scientific and Engineering Computer System (FOSECS) project, will be a distributed environment consisting of high-performance computing facilities, desktop computing facilities, and visualization facilities capable of multilevel (concurrent classified and unclassified) processing. Program specific systems will still be dictated by the particular needs of the programs but will probably be compliant with the Open Systems interoperability standards.

Integrated CASE tools and optimizing high-level programming languages will be part of the S&E software environment.

5.3.4 Direction for Office Automation

Office automation will transition from the centralized architecture of today to a distributed, microcomputer-based architecture. The future architecture will shift much of the processing load onto the desktop devices. Generic functions, such as printing and file management, will be allocated to central components when size warrants, but all other functionality will be allocated to the end-user's personal computer or workstation. A suite of commercially available software will be integrated to provide the office automation functionally.

5.3.5 Direction for Data Communications

The data communications environment is moving toward a multilevel, division-wide network that supports data, voice, and video services. It is expected that for at least the next decade the DoD standard network protocols (TCP/IP) will be supported and will eventually coexist with the International Standards Organization's (ISO) Open Systems Interconnection (OSI) protocol suite. Local networks will connect distributed platforms and client devices to the backbone network. The distributed computing requirements will drive the required network bandwidth beyond 1 Gigabits/second (Gbps).

5.3.6 Direction for Desktop Devices

The trend toward distributed processing will continue to the desktop level as more and more power becomes available in smaller and smaller boxes. By the mid-1990s, microcomputers capable of processing 100 million instructions per second will be available

and affordable. These machines will be some 250 times faster than the original PCs that entered the market around 1980. High-speed workstations featuring high-resolution graphics will also become prevalent as scientists and engineers move away from traditional terminal-to-host processing. Desktop devices will be used more frequently as hosts in their own right and will require host-to-host networking to achieve data transfer rates consistent with their processing speeds. Desktop systems will likely transition from DOS as a standard to OS/2 and the UNIX operating systems. As encryption technologies become more cost effective, secure processing at the desktop will become more commonplace.

5.3.7 Representation of the Future Technical Architecture

Figure 5-5 presents the future technical architecture in the same format used to present the current technical architecture in Figure 5-1. The figure reflects, as much as possible, the directions for each technology area as discussed. Figure 5-5 represents the technical architecture to which NSWCDD is likely to transition within the next 10 years. However budget constraints, changes in technology, and shifting requirements will necessitate many interim solutions during that period. The technical architecture to be employed in the near term (next 2-3 years) will be strongly influenced by the need to utilize existing technical facilities.

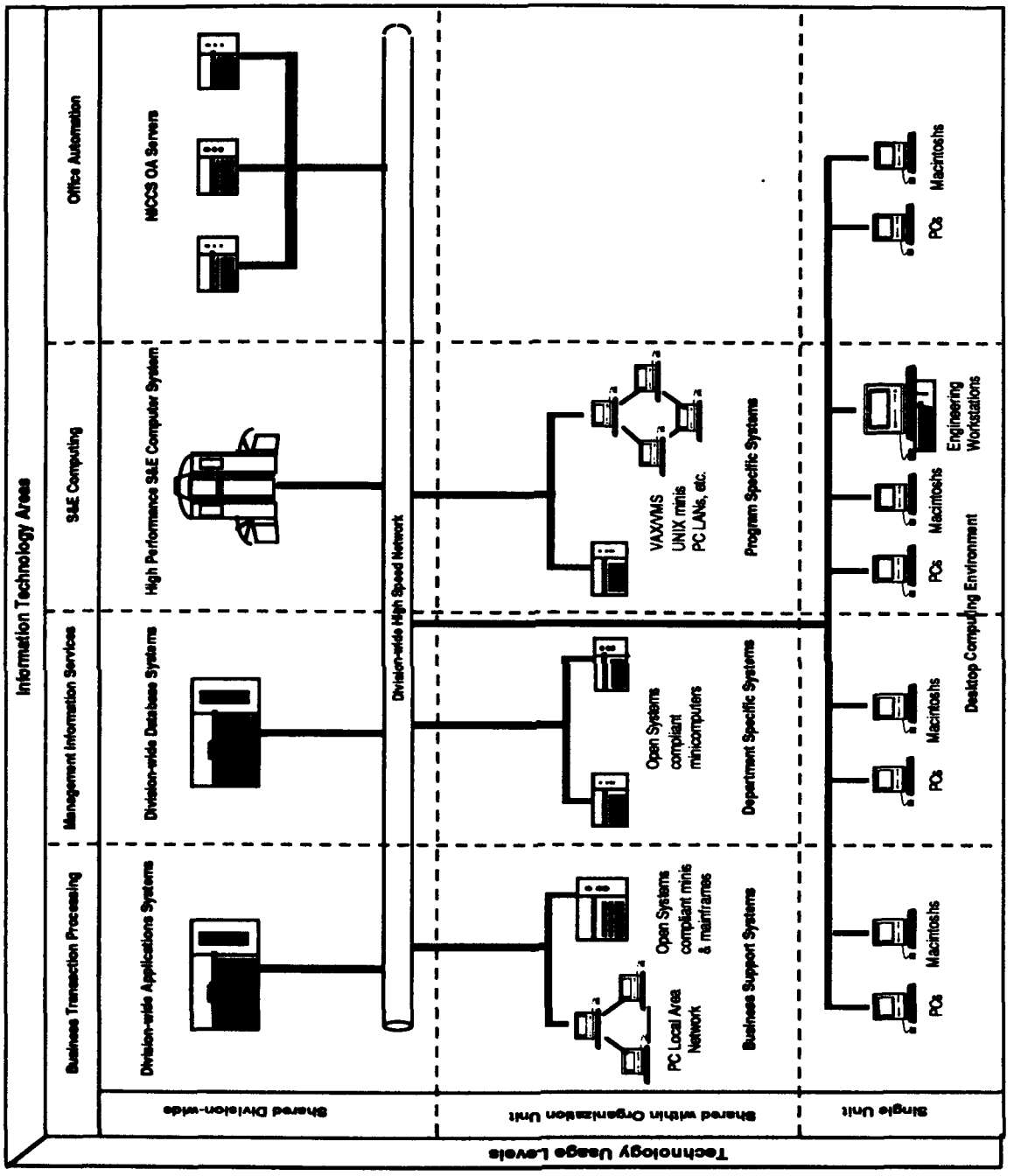


Figure 5-5. Future Technical Architecture

CHAPTER 6

ORGANIZATIONAL ENVIRONMENT

6.1 Assessment of Existing Organization

The current information management organization mirrors the current NSWCDD business systems organization. Individual business areas are supported in their automation needs by dedicated teams and individuals, either within their own organizations or from the Systems Division. There are a few examples of a process and infrastructure that encourages common methods of system development and support across pertinent areas. This, of course, contributes to the phenomena described in the earlier chapters of this report: vertical systems that address the functional requirements of particular parts of NSWCDD, with little data, function, or process sharing.

We can also assess the central systems group against the Software Engineering Institute (SEI) Maturity Framework.[10,11] The NSWCDD Software Process Assessment (NSPA) Program has adopted this approach. NSWCDD is participating in the Navy Information Systems Management Center (NISMC) effort to establish a DoN IRM Assessment Program. NISMC is developing guidelines to be used by DoN organizations in assessing and measuring their internal controls and procedures in the areas of IRM and Information Resources. Figure 6-1 is a high-level depiction of the maturity levels of the SEI framework. The goal is an effective software process. An effective software process is achieved when (1) the process is well-defined and controlled, (2) the people are well-trained and experienced, and (3) the software tools are efficient and effective. We recognized from the onset[2] that the processes used to develop and maintain software within the new division would need to be changed and that we did not have the proper skills mix to support new methodologies. IE, using integrated CASE tools was chosen as the process to be used. Project management across the entire program, using automated systems, was initiated. A large training program was begun to update the skills of the people in the new techniques. A special project was initiated to test the new processes and refine them for our use. The goal was to examine the proposed process by developing a live application needed by NSWCDD. Refinement of the processes is still going on as more groups use the newer methodologies. The project management is still being shaken down. We are researching configuration management for a CASE, data administration, and repository environment. Basically, we are trying to move from level one to level three while getting the program into full swing.

6.2 Recommended Information Management Role and Structures

What is needed is a methodology that stresses data and process sharing and an organizational infrastructure that will ensure that Information Systems products developed for NSWCDD use are quality ones that directly support the goals of the entire enterprise.

Maturity Level	Characteristic	Key Challenges
5 Optimizing	Improvement fed back into process	o Still human intensive process o Maintain organization at optimizing level.
4 Managed	(Quantitative) Measured process	o Changing technology o Problem analysis o Problem prevention
3 Defined	(Qualitative) Process defined and institutionalized	o Process measurement o Process analysis o Quantitative quality plans
2 Repeatable	(Intuitive) Process dependent on individuals	o Training o Technical practice o Process focus
1 Initial	(Ad hoc and chaotic)	o Project management o Project planning o Configuration management o Software quality assurance

Figure 6-1. SEI Maturity Framework

An IE methodology will be used to define, develop, deploy and support elements of the NICCS. The IE methodology is a Systems Engineering methodology for data-driven systems. It proceeds from the enterprise level models in this ISP to development of corporate database(s) and individual systems for the enterprise's business needs. The methodology stresses corporate data and re-engineered processes. It is particularly good in assuring that products will be precisely defined and developed with a corporate view. An infrastructure to support the full information system life cycle must ensure quality products and services that are:

a. fully tested
b. accurate
c. reliable
d. precisely defined
e. controlled
f. maintainable
g. confined to the minimal feasible number of separate configurations
h. safe and secure

To do this the infrastructure will incorporate the specific engineering disciplines of Configuration Management, DA, Quality Assurance, System Usability (Human Factors), and Safety, and Security. It must also support facilities management, tools, research, component acquisition, and training and must do this to serve a decentralized development and support work force.

Currently, the majority of the development work on business systems is being done within the Systems Division. Over time, this will change. Information systems personnel resources will exist throughout NSWCDD. Specification development will be handled within the organizations that best understand the function being automated. In time, NICCS clients will also design and develop required sub-systems. The Systems Division will provide program management and systems engineering expertise for systems integration, facilitation, and management control over NSWCDD's information systems investment. By providing clients with policies, standards, and easy-to-use development tools, the development of applications will transition to customers.

6.3 Overall Organizational Impact

The NICCS Program will change the way information systems are managed, engineered, designed, developed, deployed, and maintained at NSWCDD. Some of the change will be immediate and some will evolve over the next five years. The following items are those currently anticipated.

First, in order for NSWCDD managers to gain trust in the quality of the information presented to them, data will be managed as a NSWCDD resource. As such, access to this resource will be established through NSWCDD DA. The data will have specific definitions and naming conventions; i.e., the same piece of data will not be called by different names in different systems. Security, edit criteria, and update requirements will be well-defined and published. Data custodial responsibilities will reside in individual organizations having cognizance over specific data; e.g., the Comptroller has fiduciary responsibility for financial data. The NICCS program will facilitate the process by synthesizing individual organizational views into NSWCDD-wide views that identify interrelationships of data between organizations.

Second, standards that support the NICCS development methodology and that provide a common development infrastructure will be identified early in the life-cycle. All development and maintenance teams will adhere to the standards. The Systems Division will develop system usability standards and enforce their use. The system usability standards address client interaction with NICCS systems and facilitate information sharing and lessened training and support costs. Standards for off-the-shelf application software tools will be adopted.

Third, NICCS will be the official information repository of NSWCDD. Information that is presented to Command or to external organizations must be consistent with the official information.

Fourth, clients will be involved heavily in the design and development of systems. Participation by representative clients produces better systems more quickly. Such systems are better accepted by the total client community. Figure 6-2 is a schematic[12] of the system design synergy which results when clients are involved. Systems that cross organizational lines are not owned by an individual department. Product control mechanisms will assure that all cognizant organizations are part of the decision making process regarding the systems.

Fifth, traditional roles will change as data entry and access points change. Data entered once will support a variety of functionalities. Information will be available, at appropriate times, for client demand access. Clients will have a variety of mechanisms by which they can access authorized information. These mechanisms will range from standardized reports distributed on a prescribed schedule to ad hoc query support for seeking display of real-time data online. A client service operation will provide ad hoc and custom reporting support for those clients with information requirements but who have no real need to become proficient in data access methods.

Last, real-time manipulation of reusable data will minimize the effort to respond to data calls; i.e., fire drills. Generally, the majority of data calls involve looking at the same data in a slightly different way. By having the complete pool of accurate, up-to-date data accessible as needed, we can attain the desired view of the data.

6.4 Conclusions for Measures to be Taken

A support infrastructure, that ensures that information system products for NSWCDD use are quality ones that support the entire enterprise, will be put in place for NICCS. This will be accomplished in two stages. Initially, a Systems Division infrastructure will be formed as shown in Figure 6-3. This infrastructure encompasses the engineering disciplines necessary to ensure quality. They will be in place to support the accomplishment of the initial tasks defined in the Information Strategy, as presented in Chapter 7.

When the requirements for the NSWCDD-wide Information Management infrastructure are known, a more permanent infrastructure can be evolved to fulfill the requirements. These requirements will come out of the analysis of the Information Management Business Area. They will change the scope of infrastructure needs from what is needed by the Systems Division to accomplish tasks to the needs of NSWCDD to manage all of its information systems -- both manual and automated. This infrastructure will undoubtedly contain the same disciplines but will need to address NSWCDD-wide programmatic and control issues.

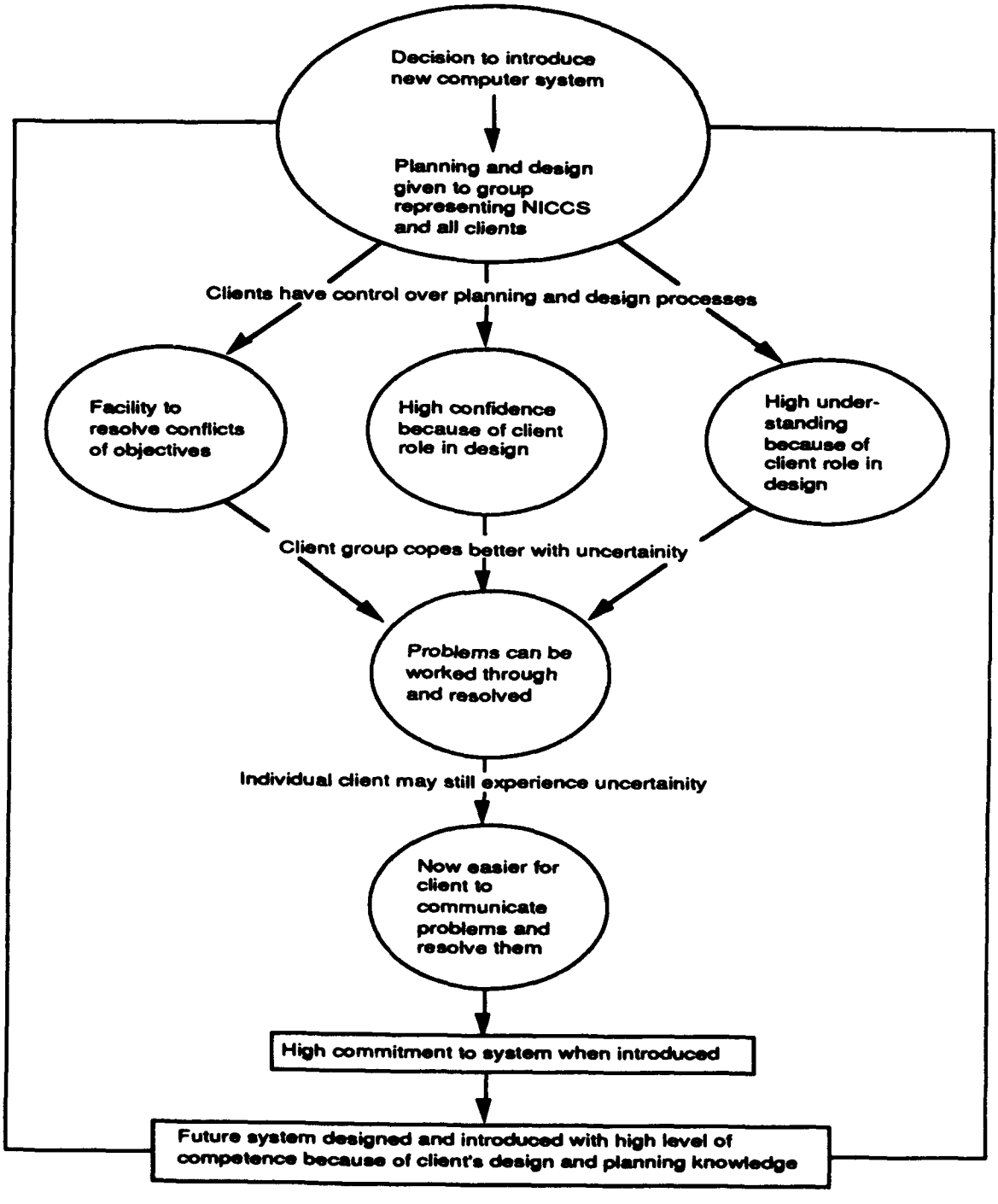


Figure 6-2. System Design with Client Participation

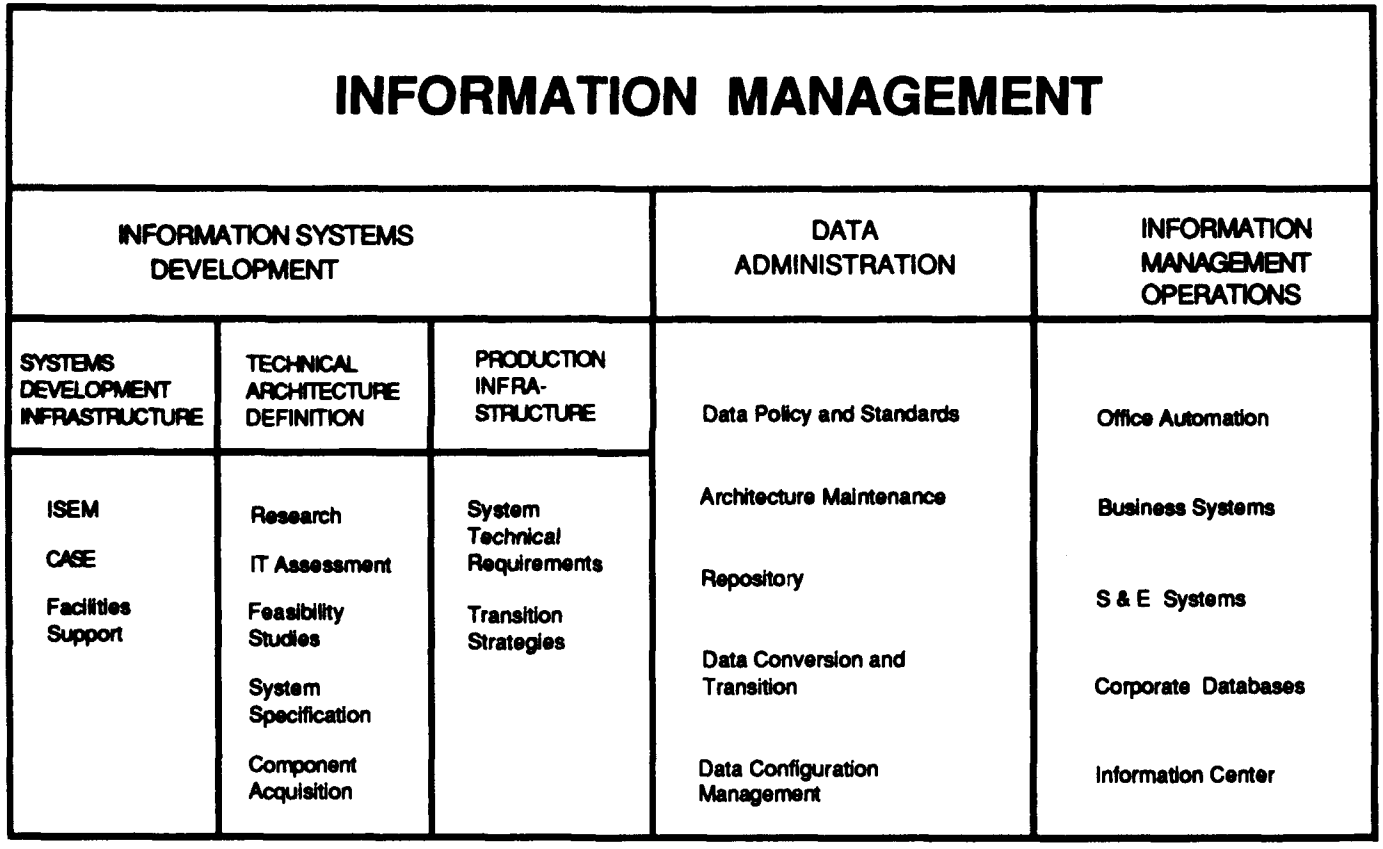


Figure 6-3. Information Management

CHAPTER 7

INFORMATION STRATEGY

The ISP has specified a very large, complex, and highly interrelated model to be used for information technology system development. The model reflects the complexity and flexibility under which NSWCDD operates. The information strategy should be driven by business needs. To meet the business needs will require that strategies also be pursued to assess and implement a technologically effective infrastructure. The largest business drivers are as follows:

a. need to lower NSWCDD operating costs
b. large administrative burden on line management and technical staff
c. non-compliant financial management system
d. DoD CIM-mandated systems looming
e. multiple sites needing to share information
f. lack of coordinated data
g. less functionality in office automation than desirable

These drivers combine in different ways to direct which business areas should be analyzed first and which information organization strategies are required immediately. The strategies below are fairly risky and will tax the abilities of the Systems Division to proceed on such a broad front. The political situation and environment of NSWCDD and the NICCS program, however, drives us to this course of action. There is a risk of slipped deadlines. If not too delayed, the damage may not be too bad as the CIM and NAVSEA efforts may also not meet their schedules. CIM is behind its objectives at this time because they were also pursuing a very aggressive course of action. There is a large risk of funding being cut to the program. The result of deep cuts would be the inability to carry out these directions and the consequential inability of NSWCDD to be relieved of the severe productivity deterrents represented by the drivers.

The strategy has been formulated for the first steps and is discussed. When these efforts are completed, the next steps will be determined. The volatility of the environment makes setting direction for the longer course ludicrous. We have, and will continue, to pursue the course that makes best sense for NSWCDD while adjusting to external drivers.

7.1 Focus on Finance

We will follow a focused effort in the Business System area. A focused effort is needed because of the extreme pressure of drivers a, b, c, and d. The focused effort will include the Financial Management area and that part of the Planning & Review area that involves financial data. This is a risky direction to take but is necessary because of time constraints. NSWCDD must be able to define its information and process requirements in this area before CIM furnishes financial systems to do the financial transaction processing. Without the NSWCDD

requirements, we would be unable to effectively respond and implement those systems. If CIM does not produce a financial system, we must still pursue this direction because of the non-compliant status of the current financial management system.

This is a risky direction to take because the Financial Management area is the largest and most politically charged of the Business System areas. Since we have never done a full-blown BAA before, we are on a learning curve. We will employ outside consultants to help us learn and to perform quality assurance on the BAA models. If we make some "mistakes", the results would not be terrible because the results of a BAA are usually modified somewhat in the follow-on business system development activities. The whole IE approach is one of modifications of the models at all levels as both the enterprise itself changes and new approaches to business in response to outside influences is made. The DoD CIM, DoN, and NAVSEA efforts will probably require adjustments to be made also; e.g., new requirements for reporting or tracking are placed on activities by parent organizations because the ability would then exist to track and report the information. The bigger risk is in the political arena within NSWCDD if the analysis points to different organizational structures, sizes and roles.

7.2 Creative Corporate Data Development

We will move out of the normal IE methodology and pursue the development of the CDB in parallel with the focused effort. The CDB is the logical database containing all of the business data of NSWCDD. Normally, the BAAs define the data needs. We will attempt to build preliminary databases comprised of data elements already found in some existing systems. We are taking this tack because of drivers a, b, d, and f. This effort will also focus on financial data initially.

While the ISP effort was in progress, we had another project underway. This project dealt with the reverse engineering of the current financial management system files and programs. This preliminary work is the beginning point for this effort. That information will be used to define new logical and physical databases for a relational database environment. Programs to extract and move data from the old system to the new databases will be developed. As the focus effort in the Financial Management BAA evolves, modifications will be made to the CDB to reflect the actual data needs and definitions. It is believed that more requirements for data exist than are satisfied in the current Financial Management system.

The CDB effort will be involved in more than the data requirements of the Financial Management BAA. As was seen by the diagrams and charts in Chapter 4, every business area updates or reads data from many other business areas. In particular, data stores from the Organization Management and Product Development business areas will need to have skeleton databases developed. The principal data requirements for Organization Management were automated several years ago. The CHRIS was developed for the Human Resource Department and is based on relational database technology. It will form the basis for the supply of personnel and organizational information needed for the Financial Management business area. Data extract programs will need to be developed between CHRIS and the CDB. Of course, eventually, CHRIS databases will become a part of the CDB. Skeleton databases for the other data needs will be

defined and populated, pending proper definition at a later time. Techniques will also have to be developed for the population and low-level maintenance of these skeleton databases.

The principle risk involved with this effort is the possibility of restructuring the new databases when the focused effort is complete. The data extract programs would have to be modified to reflect the changes. The end result of this effort is positive regardless of the ability to continue with development in the Financial Management business area; e.g., CIM is not ready with financial transaction processing systems. First, the definition and population of these databases would permit any new requests or needs for financial reporting to be made from these databases. The report writing would be done with better tools and languages, which would permit faster, cheaper generation, and modification of the reports. Second, depending on the anticipated time lags for the replacement of the current Financial Management system, it might be cost-effective to re-engineer programs that are the most costly to maintain now and move them to a better language and/or tool using the new databases. This technique has been quite effective in many commercial companies in reducing their maintenance costs dramatically in the short term. Last, the ability to extract data from the CDB to organization-specific financial systems is greatly enhanced; e.g., large programs at NSWCDD have their own financial tracking and reporting systems tailored to sponsor requirements.

7.3 Determining Data Administration

Moving into a controlled information environment requires the establishment of a DA function. This is the principle infrastructure media for effecting the proper environment for information management and the coordinated development of information systems. In particular, drivers a, b, d, e, and f strongly support this strategy. This effort is related to driver d because the function is the focal point for the DA efforts being done within DoD by CIM and DoN to standardize data element names and definitions across all business systems within DoD. Any systems we develop would be required to follow these naming conventions.

DA deals with the management and control of data as an enterprise asset. It includes strategic information planning, data modeling, logical database design, and the establishment of standards, policies, and procedures for the care and feeding of data; e.g., ownership, security, privacy, quality, and integrity. DA leads to improved NSWCDD profitability as indicated by Figure 7-1.

We will establish a DA function at NSWCDD. The functions described within the scope of DA at NSWCDD will include: DA representation, policies, guidelines, and standards; DA partnerships; data planning; the data repository and configuration management; compliance with DA policies and standards; and DA measurement of program effectiveness. These functions are consistent with the DoD and DoN DA guidelines, directives, and implementation procedures. The DA function will be performed by employees and organizations all across NSWCDD. The DA staff within the Systems Division will coordinate and guide these activities and will perform some functions only themselves; e.g., model management for the NICCS program.

Higher Productivity

- o Faster application development
- o Lower maintenance activity
- o Direct client involvement in application creation
- o Application of more immediate value to client

Better Information for Decision-making

- o Flexible access to all NSWCDD information
- o Up-to-date information
- o Ability to retrieve management information quickly
- o Correlation of information from different sources

Greater Responsiveness to Computer Users

- o Report generation without conventional programming
- o Fast responses to new requests for information
- o Client capability to extract the information they need when they need it

Figure 7-1. Why Data Administration?

7.4 Implications for Information Management

The establishment of the DA function will not solve the information problems of NSWCDD by itself. DA is a piece of the bigger infrastructure and services needed to manage information at NSWCDD. The proper management and use of information at NSWCDD would produce the biggest benefit to NSWCDD -- more than financial management. NSWCDD as an R&D center is in the knowledge business. We take information and transform it into services or products. Being able to access and use information effectively is the key, therefore, not only to the proper functioning of our business processes but also to our producing products and services. Lack of automation support for collaboration inhibits our ability to make teams of people across sites. Lack of automation support for the survey of outside information on developments in our areas of business increase the time it takes our personnel to stay abreast of their technical fields and increase the risk of missing a vital piece of information that might make a breakthrough possible. Lack of coordinated data to respond to outside fire drills drains the time of our line managers from technical leadership efforts. The list is quite long. Defining good information management is critical to the solutions for drivers a, b, e, f, and g.

The analysis of the Information Management (IM) business area is the most difficult technically of all of the business areas and is tightly interwoven with all other work stemming from the ISP. The IM business area will be difficult to perform because its analysis does not completely follow the normal IE methods because its goal is more than the definition and development of systems. Part of the IM work is the identification of tools and technologies to be

employed in the care and feeding of information identified in other business areas. However, the identification of these tools and technologies will help determine the direction pursued in the other efforts -- even to the extent of suggesting information that could be created. We are left with a circular problem and a technology that moves extremely rapidly. The IM business area enables the other business areas to proceed in a coordinated and effective manner. The outcome of this effort will define the infrastructure required for the life cycle of all the systems to be developed and also will define services and functions needed to handle the various types of information used at NSWCDD regardless of the form. This latter outcome provides the rationale for making decisions about the technical architecture and permits the evaluation of new technologies applicability to NSWCDD problems.

7.5 Towards a Technical Architecture

The current architecture at NSWCDD will not permit the effective IM and handling of even our currently known requirements. We will pursue migrating towards a new architecure consistent with the NAVSEA direction as laid out in Chapter 5 and with our needs. The IM business area activity will help define functional requirements for information handling, which would need to be supported by the technical architecture. We will set up a simulation laboratory to be able to perform hands-on analysis of promising technologies and to perform sizing and performance studies of existing components and to evaluate options for reconfiguring the current architecture. We will establish a network modeling system to analyze future loads on the networks before systems are developed. Network loading may influence the implementation approach. We have already determined that some of the existing platforms will not be appropriate from a performance and maintenance perspective in the future. Migration plans will be developed as the requirements began to emerge from the other efforts. The first risk to technical architecture maintenance and migration is money for capital equipment. The second risk is timeliness because of the gap between identifying the needs precisely enough to justify and get permission to procure and the actual delivery time.

We will need to study and develop techniques for secure processing in a distributed environment. We have performed preliminary work in this area. Since much of the work at NSWCDD is classified, there is a need to be able to share classified information between sites for collaboration using electronic means. We will need to study and develop strategies for distributed data/information processing. The driver for this was discussed in Section 2.2.5. We will need to study and develop techniques for data integration for two reasons. First, such techniques are required if we are to move forward through the end-user computing stages as was discussed in Section 2.3. Second, it is most probable that we will not have control over the transaction processing systems but will receive them from CIM either as systems to run here or systems to which we will need to ship our data. In either case, data exchange will be needed between these systems and our corporate database.

Through the initial period we will attempt to make do with the existing hardware platforms, although we will upgrade the capabilities of some of them. We would like to acquire a database machine to host the larger databases, which may only be handled marginally by the existing platforms. We will perform some sizing studies of our existing platforms to determine maximum numbers of concurrent database end users who could be working in different modes;

e.g., read-only versus update and read. We will also assess the capabilities of some of our platforms to be servers in a new office automation approach. We have already performed preliminary studies of the size PC that would be required in the future office automation environment. NSWCDD has a large investment in PCs and workstations. We want to preserve that investment as much as possible. Upgrades of the lower power level PCs will probably be necessary. Of course, since a new office automation approach would not be in place for awhile, the natural attrition of PCs may reduce the scope of the upgrade problem. .

CHAPTER 8

PROGRAM PLAN

The Program Plan has been developed only for the near term. We can postulate longer term strategies, but the volatility of the environment may even change the strategies. Figure 8-1 shows the Program Plan through FY93. It supports the Information Strategy given in Chapter 7. Not shown on the Program Plan is the work involved in establishing and maintaining the DA function or the configuration management and quality assurance functions.

We are conducting the analysis in the Financial Management, Planning & Review and IM business areas. The analysis for the Planning & Review area will be primarily concerned with the planning data used in the financial arena. Undertaking three BAAs simultaneously is risky with respect to schedule and the learning curve is hard to estimate; but, during the ISP effort, we did run the BAA process for an application development and have a better understanding of both the IE process and how to accommodate the culture of NSWCDD.

When these BAAs are completed, we are projecting going into the Acquisition Management, Organizational Management, and Facilities Management business areas. The consolidation is requiring a hard look at how we can support the remote locations from the Dahlgren site -- in particular support the White Oak site because support personnel were not in the manpower count for the drawdown there. The processing and tracking of acquisition requests (stubs) electronically would be a welcome capability. The Organizational Management business area contains the entity types read and updated by most of the other business areas. It is being sequenced here to reduce reworking of the business systems, which are scheduled to begin development in the same time frame as the beginning of this BAA. The movement of people to the Dahlgren site and the expansion of employees there will make Facilities Management another important area to consider. MILCON constructions and refurbishing of existing buildings are in the plans and a system to accurately plan and track the work and the perturbations of people space is seen as being beneficial.

In parallel with the BAAs mentioned above will be work on the CDB discussed in Chapter 7 above. The plan follows the strategy of providing financial data, followed by data related to personnel, including organizational related data. We would then move toward integrating the data requirements from the Organizational Management and Facilities Management BAA, which should be completed by the start of phase 2 of the CDB work.

In the Technical Architectures, area we will be studying and then trying to implement a scheme for an electronic mail facility, in particular. With the consolidation, came more sites with their own networks. In addition, there is a need to easily connect to external systems such as the parent organization. Even within the current NSWCDD environment, there are PC-based LANS, which serve workgroups, either programs or line organizations. Although most of the electronic mail interchange within a work group stays within the work group (estimates are

usually 80%), some messages would need to go external to the work group. It is not effective nor efficient to have that work needing to leave the work group redone on the centrally controlled office automation system.

On the Program Plan we have indicated the beginning of the development of systems for the Financial Management business area. Three things need to be said about that line on the plan and longer term strategy for the development work. First, in Figure 4-8 the processes were laid out by Business Area and type of work that they did; e.g., transaction processing or support of strategic decision-making. We believe that the CIM program will provide us with the transaction processing systems and, in all likelihood, we will be prevented from developing our own transaction processing systems. For example, civilian payroll is scheduled to be processed at central DoD sites, and all travel requests are following a similar path. The CIM systems may flow into the area of monitoring and control also so that roll-ups and consolidations of data by higher echelons can be performed. We will probably be most concerned with implementing systems supporting the other two types of processing; i.e., in support of planning and analysis and in support of strategic decision-making. Second, NSWCDD currently has a non-compliant financial management system. We cannot wait too long even for the basic transaction processing system. Lastly, the first stage of the development process is the design of the systems based on a further refinement of the business area analysis. We may need to perform the top-level design of the transaction processing systems also just so we can more easily understand where and how the mandated systems fit into our information strategy plan, corporate systems, and corporate databases. At a minimum, we will need to know how the data from the mandated systems will interface with the CBD.

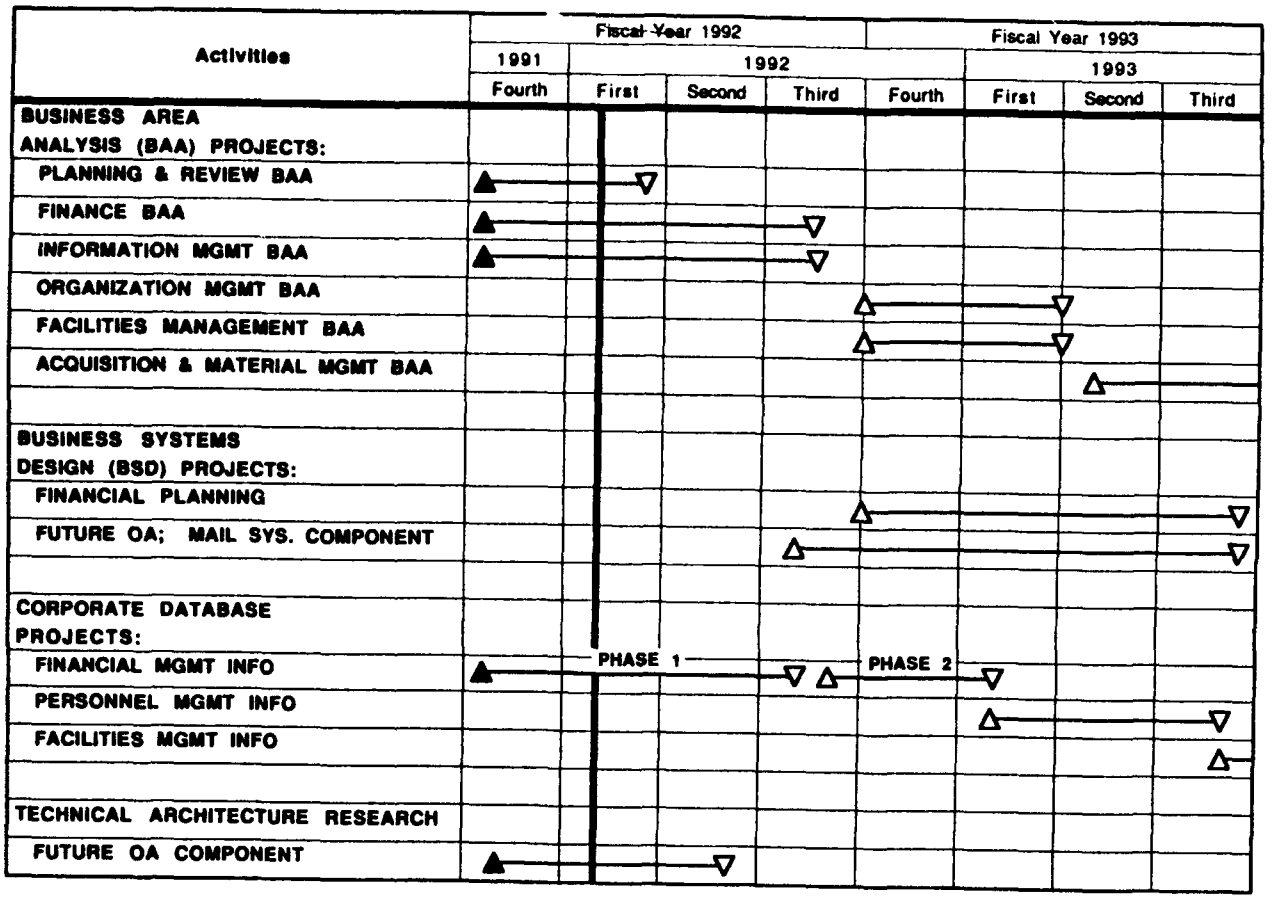


Figure 8-1. FY92-FY93 PROGRAM PLAN

CHAPTER 9

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APPENDIX A

DETAIL FUNCTIONAL DECOMPOSITION

The Functional Decomposition presented in this appendix represents the ISP detailed functional decomposition work. These diagrams combine the process-to-process relationships with the process-to-entity type relationships in a pictorial form which is easy to read. The diagrams were used to validate the models contained in the CASE tool. Some supplementary information which addresses the syntax and semantics of this diagramming is provided here to assist you in understanding the diagrams.

Definition of Function and Process

Functions and processes are simply the activities that an enterprise needs to perform to carry out its mission. Functions are made up of processes by definition. The emphasis in the analysis was placed on "what" NSWCDD does and not "who" does it, even though the diagrams may suggest which current organization performs the function. This purely functional view allows opportunities for process improvement and data sharing from a neutral, non-parochial point of view.

The decomposition of the functions do not imply levels of an organization. For example, resource planning could be done at any management level. It is important to not associate organizations or management levels with functions and processes at this time. Entering the TQM/TQL world should dramatically change **where** and **who** performs functions and processes.

The basis for this analysis is that all functions are a delegation of management -- principally line management. An enterprise may choose to organize some of its functions to take advantage of volume processing. Another example would be for greater effectiveness because some function required detailed fiduciary understanding; e.g., finance or personnel. Again, we must remember that current organizational structure may not be the best organization to carry out the functions of NSWCDD when viewed in totality and not in vertical slices matching the vertical nature of the DoN structure.

Definition of Entity

Entities are simply the things that an enterprise needs to keep information about. Entities can be persons, places, things, concepts, events, etc. that have some meaning and importance for the enterprise. Entities can be categorized into entity types and thought of as particular occurrences of an entity type. For example, if ORGANIZATION was modeled as an entity type, then the entity ENGINEERING AND INFORMATION SYSTEMS DEPARTMENT might be a single occurrence of that entity type.

Definition of Relationships

In the diagrams that follow, we represent three relations: (1) relationships between functions and functions or functions and processes, (2) relationships between activities and entities, and (3) relationships between external entities and activities.

The first and third relationships are both indicated by arrows and expressed as the kind of data flow needed between them. We modelled our outside relationships because NSWCDD does not operate in a vacuum and, further, the external influences on NSWCDD are substantial.

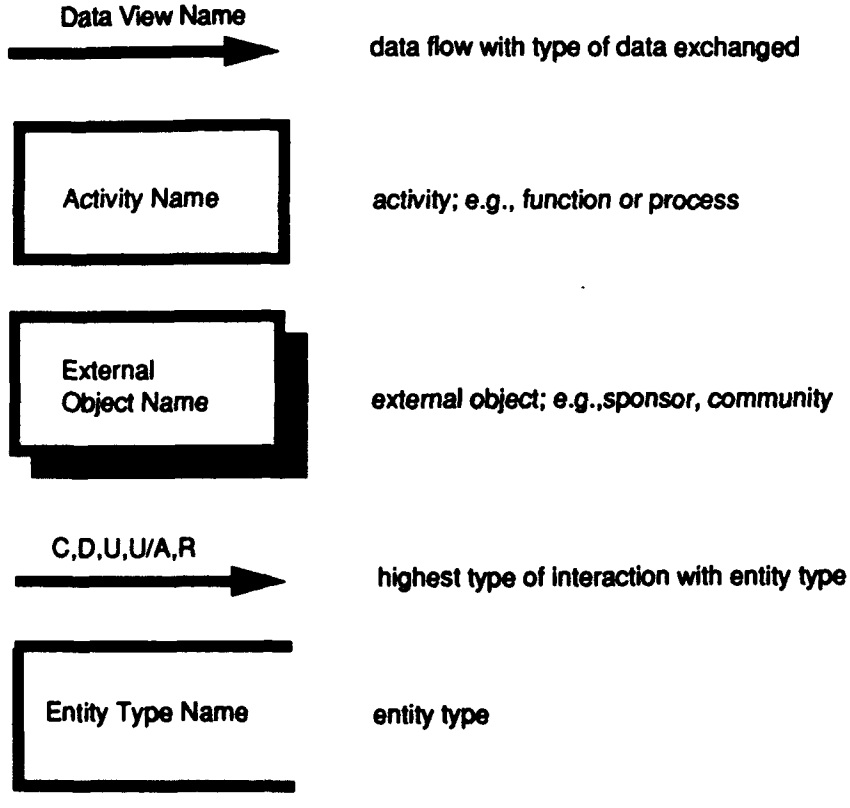
The second relationship deals with how an activity relates to entities. What the activity does to the entity type is important because almost all, if not all, entity types are related to more than one activity. This relationship is also modelled by an arrow and a code indicating what the activity does to the entity type. By convention, only a single interaction code is displayed above the arrow, so a hierarchy of interactions is used.

C in a cell means the activity may create, delete, update, and read that entity type
D means the activity may delete, update, and read the entity type
U means the activity may update and read the entity type
U/A means the activity needs to associate information with the entity type
R means the activity may only read the entity type

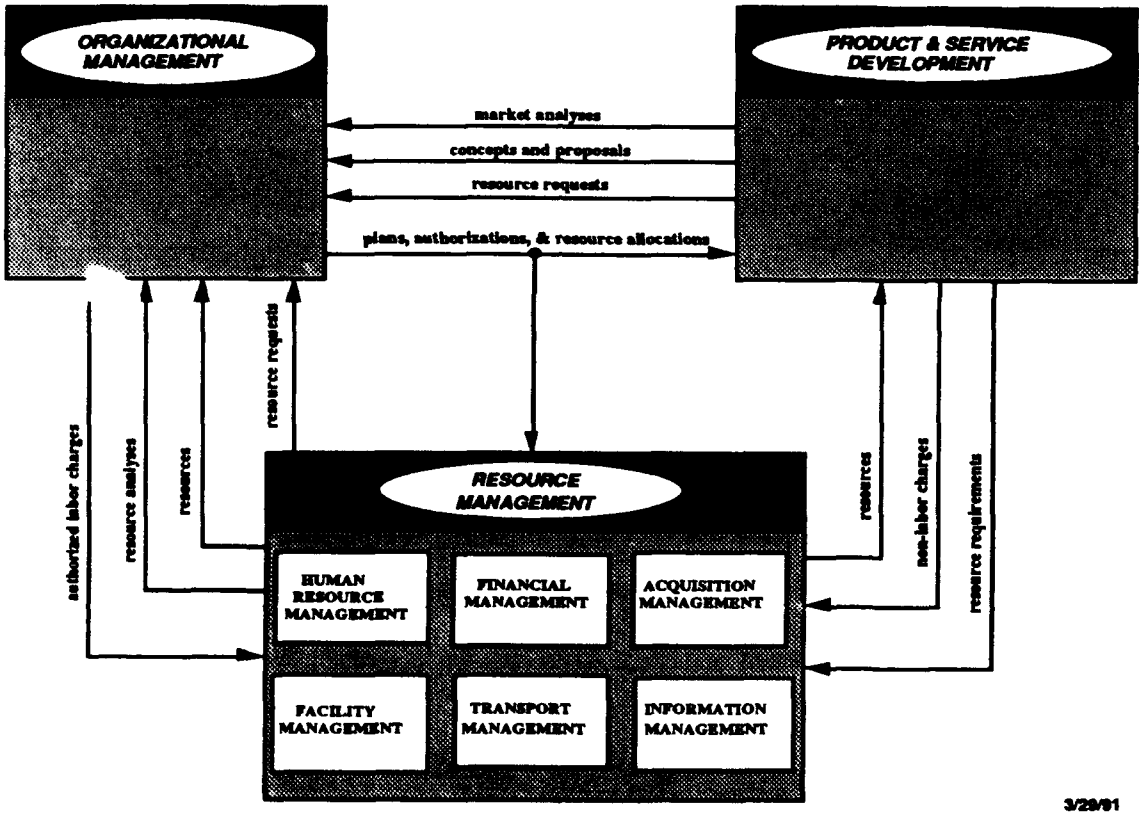
The **U/A** relationship is not as obvious as the others. The best way to describe it is to use an example. The process ACCEPT & ALLOCATE FUNDS needs to associate with the funds the SPONSOR, PROGRAM, cognizant ORGANIZATION at NSWCDD and which LABOR RATE will be used. These relationships are represented by the **U/A** code.

Conventions in Reading Functional Decomposition Diagrams

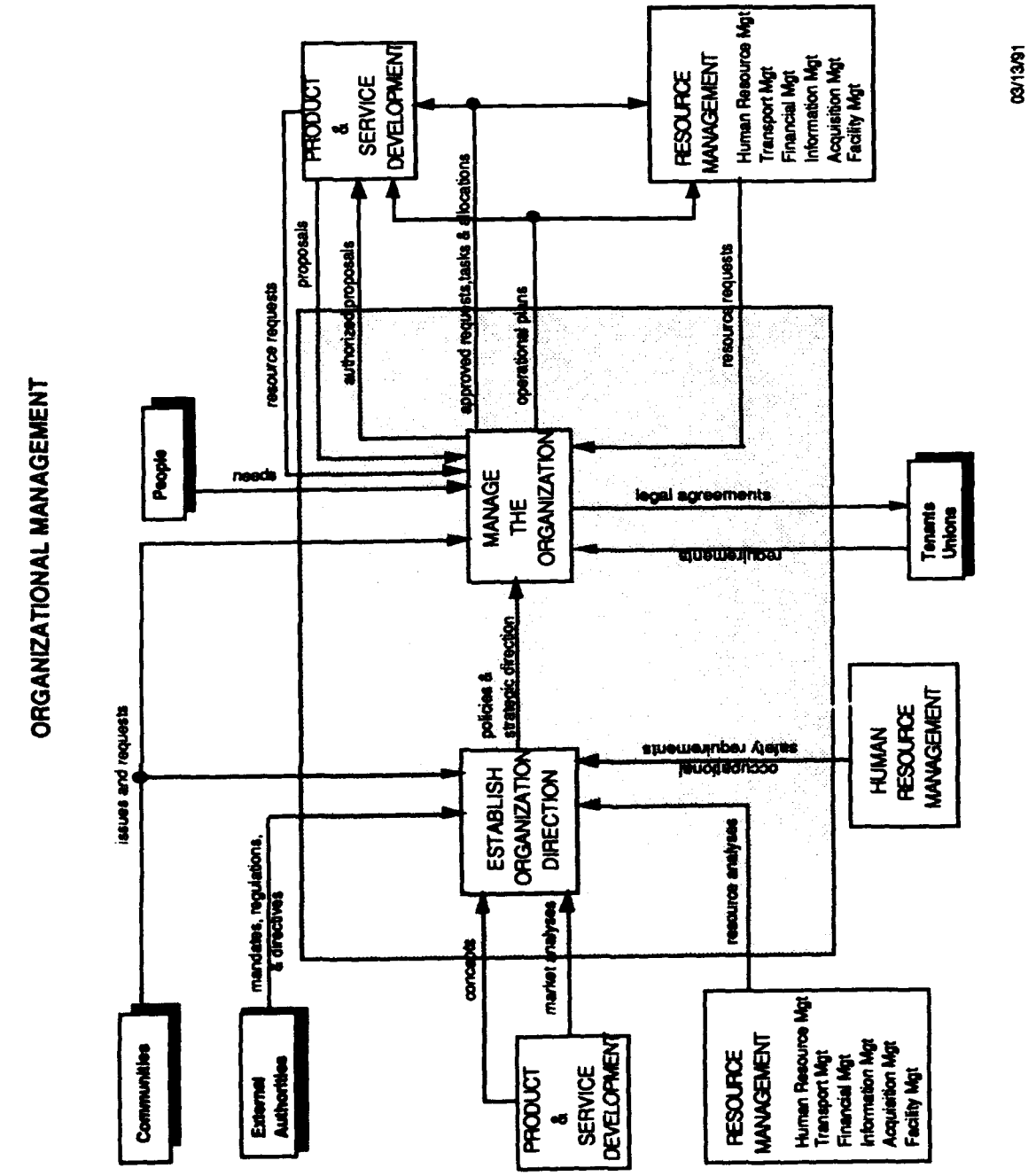
The diagrams use particular shapes to represent the items defined and discussed. These symbols are shown below. The other convention used is to show the activity represented by the function or process in a shaded box. Anything occurring outside of that shaded box is considered outside of the control range of the activity, but with which it must interact. These outside things might be real external objects to NSWCDD like sponsors or might just be a function or process which is part of another activity.



NSWCDD TOP LEVEL FUNCTIONAL DEPENDENCY



On the following pages the diagrams are in the order of the above diagram moving clockwise through the major blocks. They can be read in any order and the alphabetical list is below.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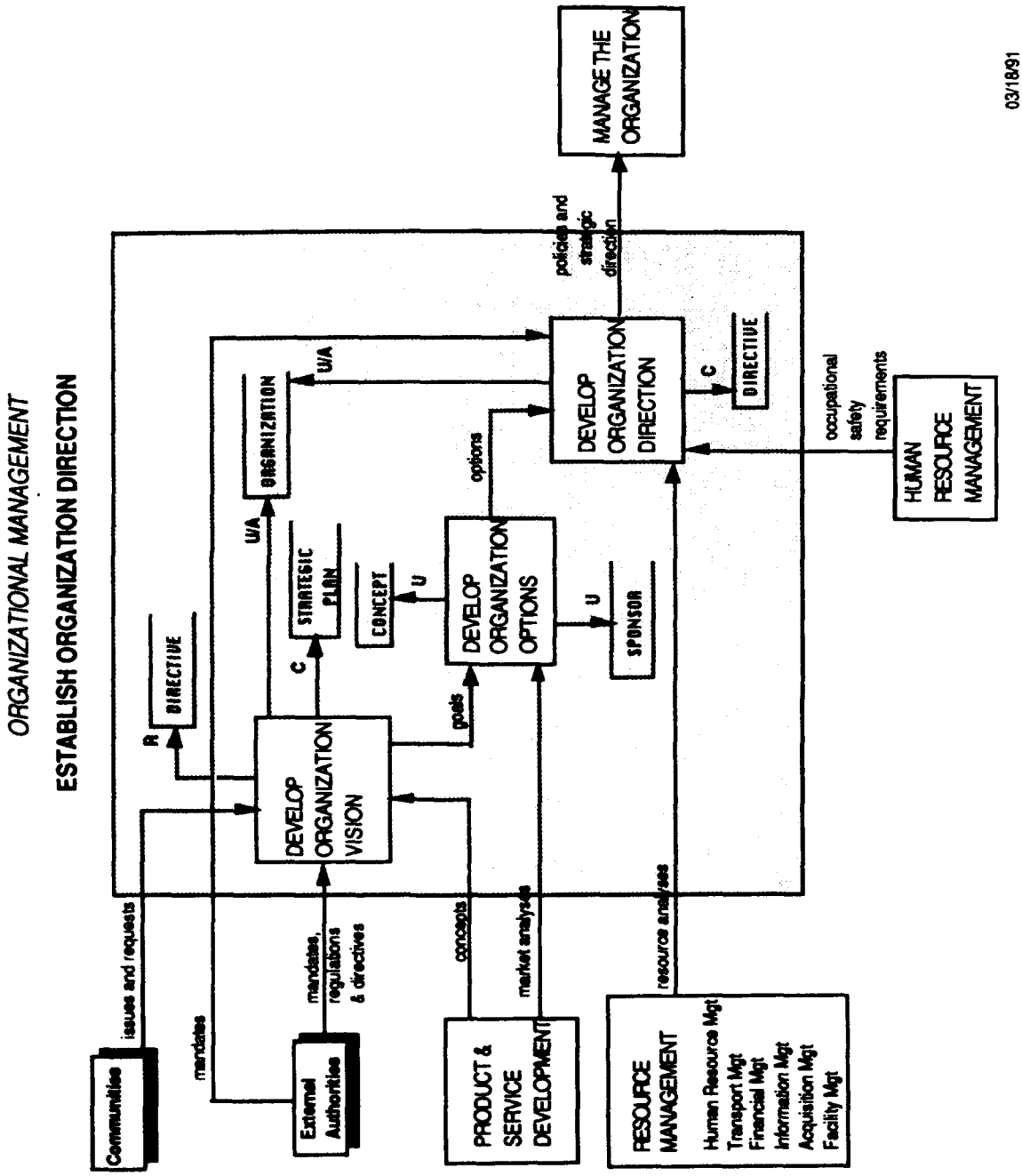
Human Resource Mgt
Transport Mgt
Financial Mgt
Information Mgt
Acquisition Mgt
Facility Mgt
proposals
resource requests
authorized proposals
approved requests,tasks & allocations
operational plans
resource requests
People
needs
MANAGE THE ORGANIZATION
legal agreements
requirements
Tenants Unions
issues and requests
policies & strategic direction
occupational safety requirements
HUMAN RESOURCE MANAGEMENT
ESTABLISH ORGANIZATION DIRECTION
mandates, regulations, & directives
concepts
market analyses
resource analyses
Communities
External Authorities
PRODUCT & SERVICE DEVELOPMENT
RESOURCE MANAGEMENT
Human Resource Mgt
Transport Mgt
Financial Mgt
Information Mgt
Acquisition Mgt
Facility Mgt
03/13/91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goals
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HUMAN RESOURCE MANAGEMENT
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mandates
mandates, regulations & directives
concepts
market analysis
resource analyses
Communities
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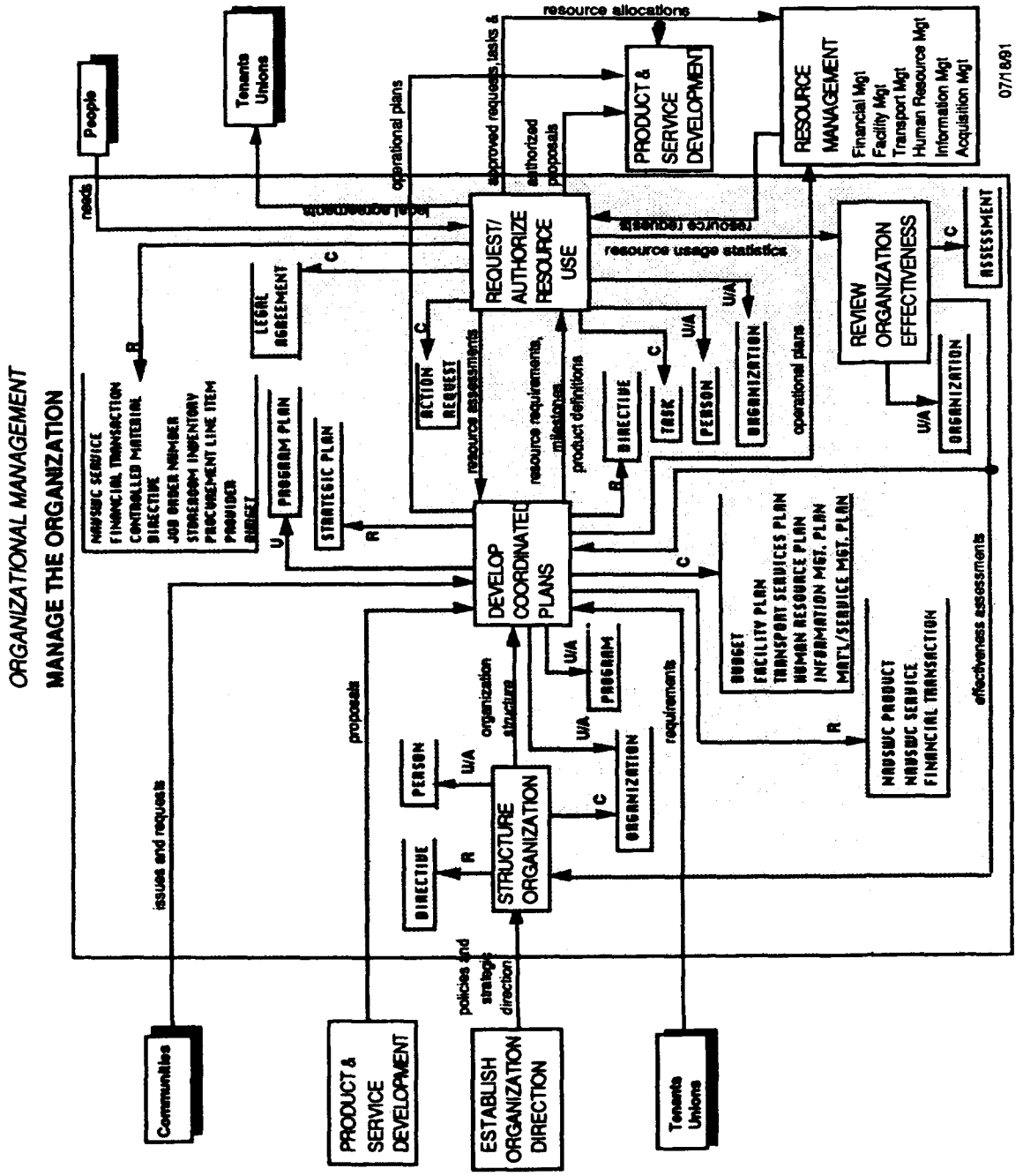
Financial Mgt
Information Mgt
Acquisition Mgt
Facility Mgt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resource allocations
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approved requests, tasks &
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Acquisition Mgt
07/18/91
needs
REQUEST/ AUTHORIZE RESOURCE USE
resource usage statistics
REVIEW ORGANIZATION EFFECTIVENESS
ASSESSMENT
LEGAL AGREEMENT
PROGRAM PLAN
STRATEGIC PLAN
ACTION REQUEST
resource assessments
resource requirements, milestones
product definitions
DIRECTIVE
TASK
PERSON
ORGANIZATION
operational plans
DEVELOP COORDINATED PLANS
BUDGET
FACILITY PLAN
TRANSPORT SERVICES PLAN
HUMAN RESOURCE PLAN
INFORMATION MGT. PLAN
MRTL/SERVICE MGT. PLAN
NAVSWC PRODUCT
NAVSWC SERVICE
FINANCIAL TRANSACTION
effectiveness assessments
issues and requests
proposals
organization structure
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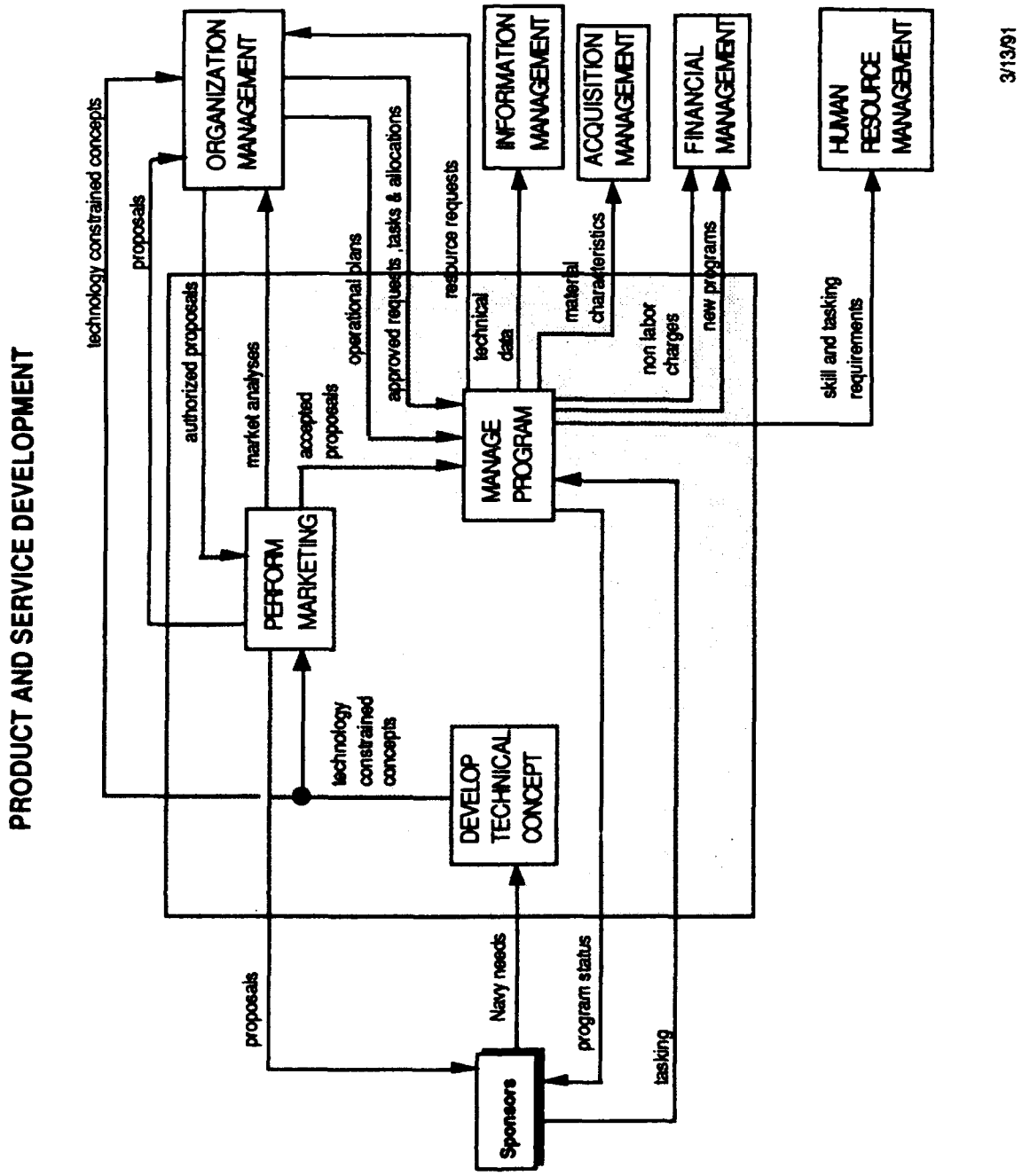
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DEVELOP TECHNICAL CONCEPT
Sponsors
technology constrained concepts
proposals
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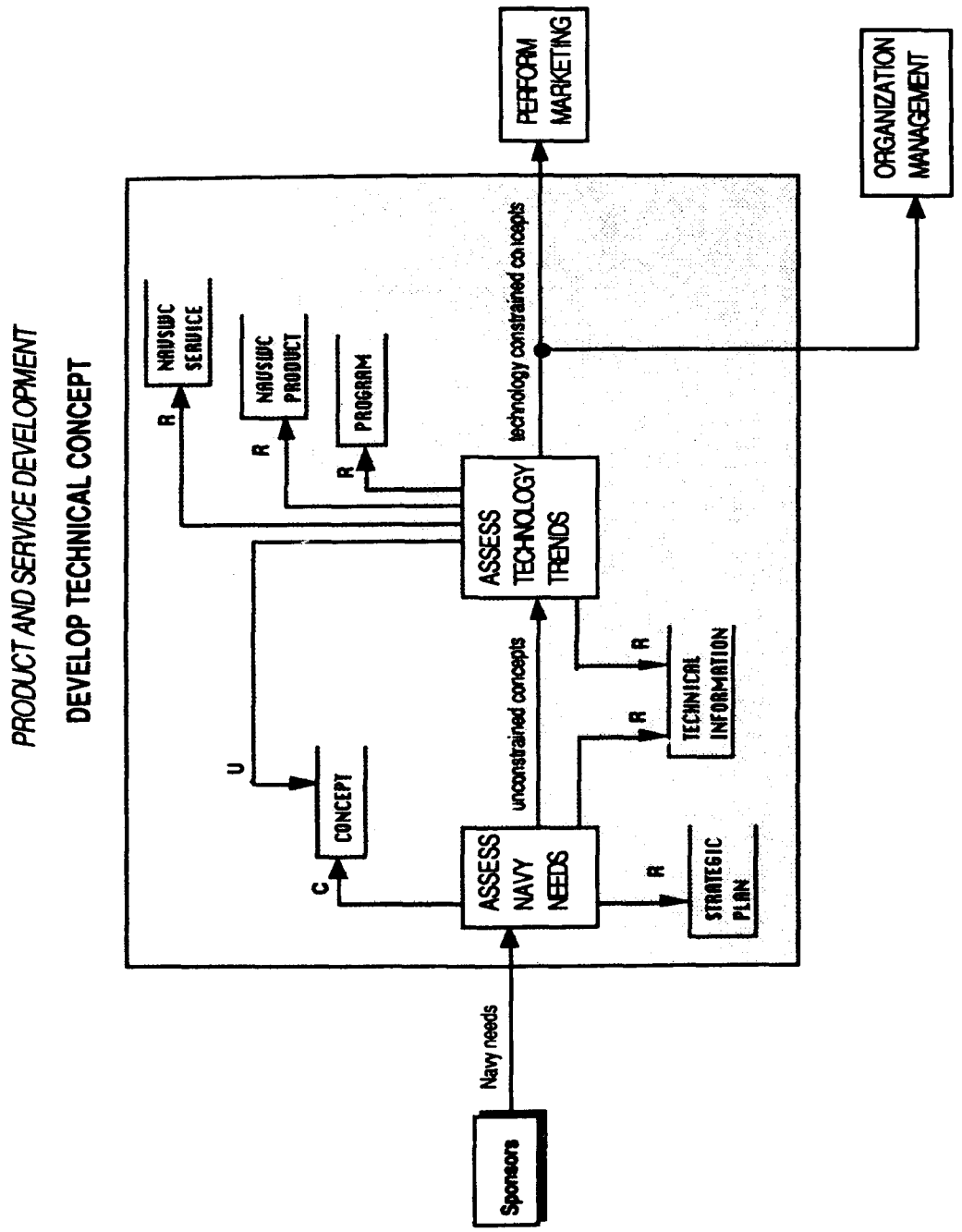
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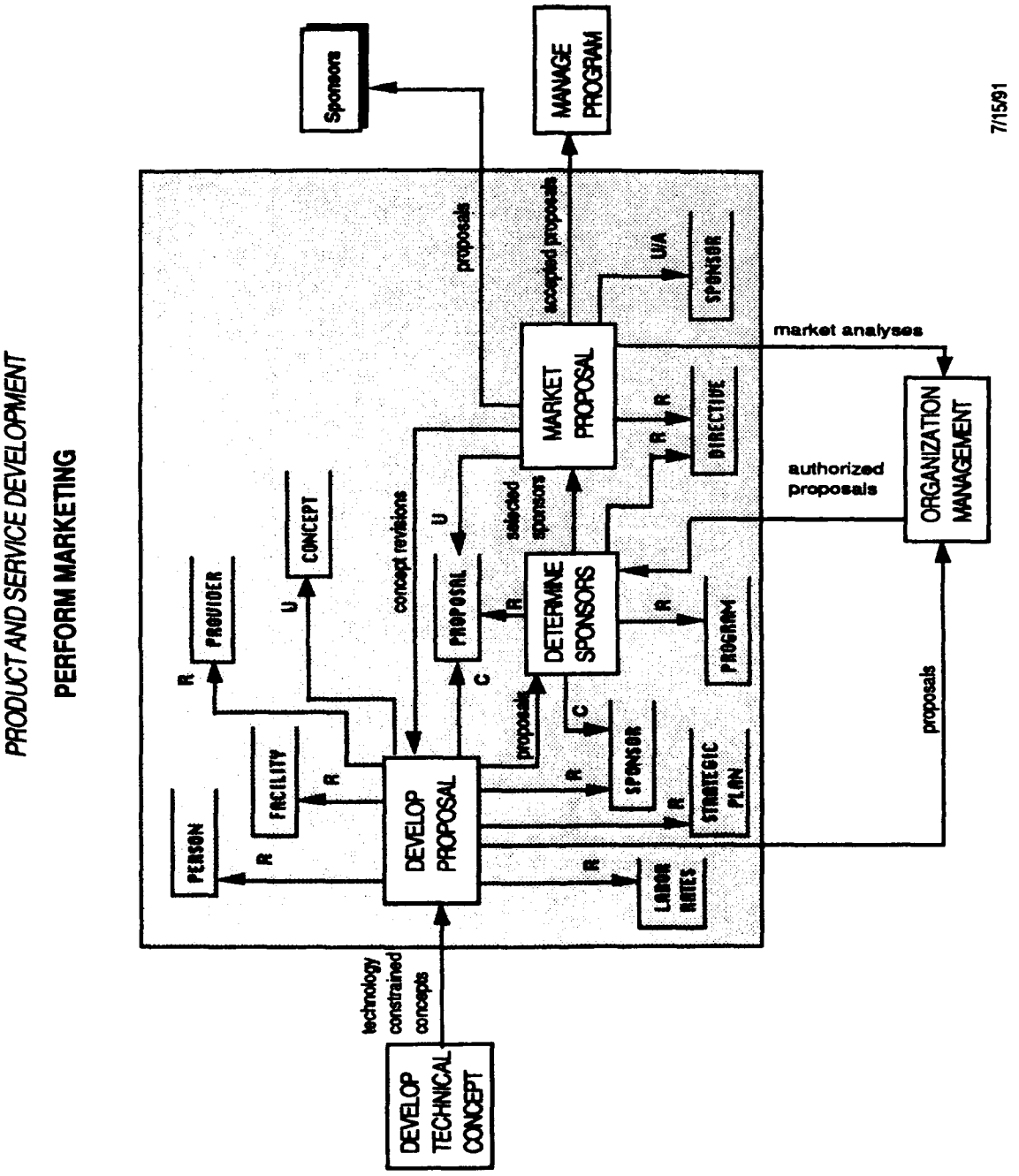
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ORGANIZATION MANAGEMENT
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PROPOSAL
DETERMINE SPONSORS
PROGRAM
proposals
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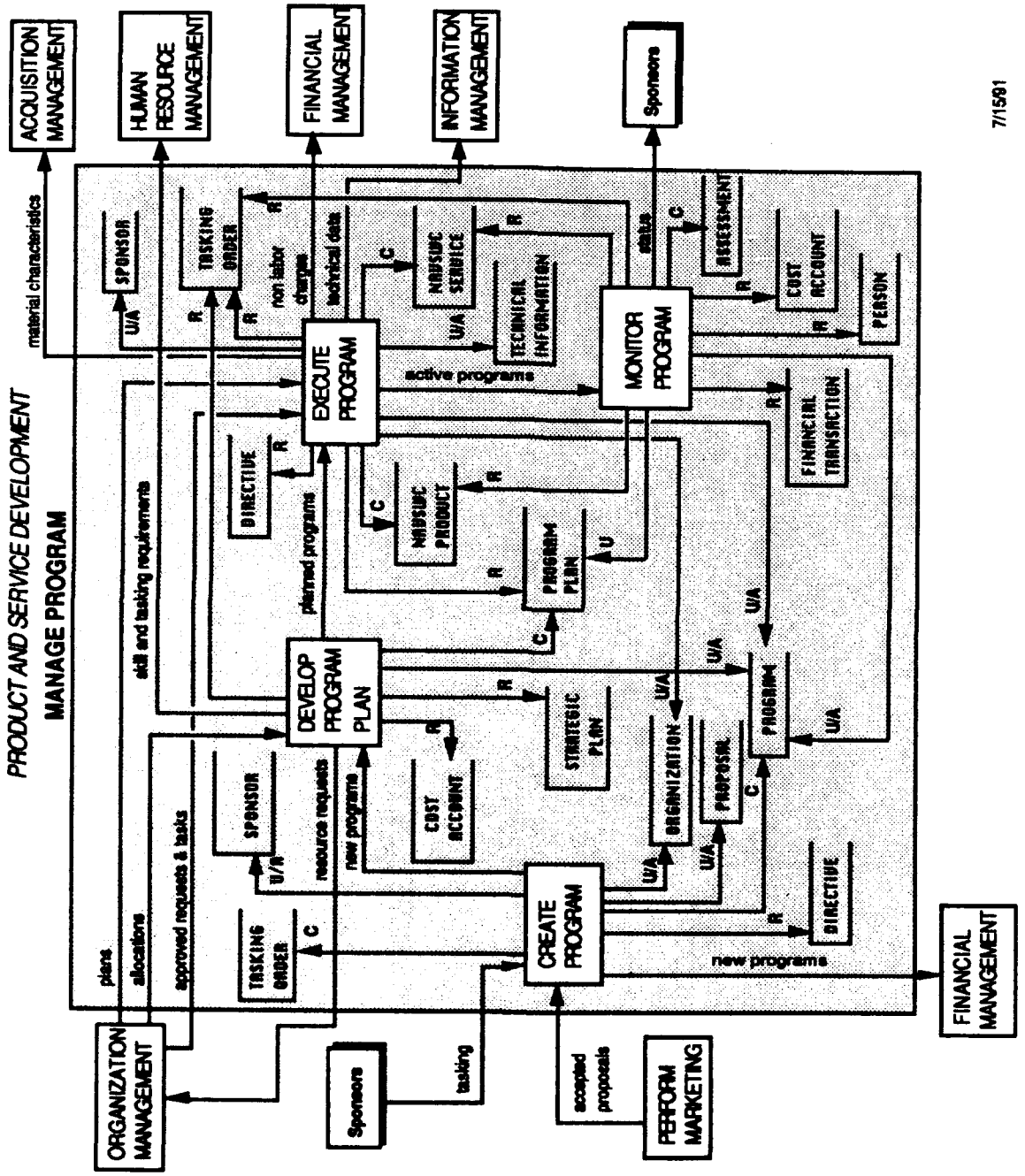
DEVELOP TECHNICAL CONCEPT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TASKING ORDER
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technical data
NONSUBC SERVICE
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COST ACCOUNT
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active programs
MONITOR PROGRAM
FINANCIAL TRANSACTION
DIRECTIVE
planned programs
NONSUBC PRODUCT
PROGRAM PLAN
staff and tasking requirements
DEVELOP PROGRAM PLAN
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ORGANIZATION
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resource requests
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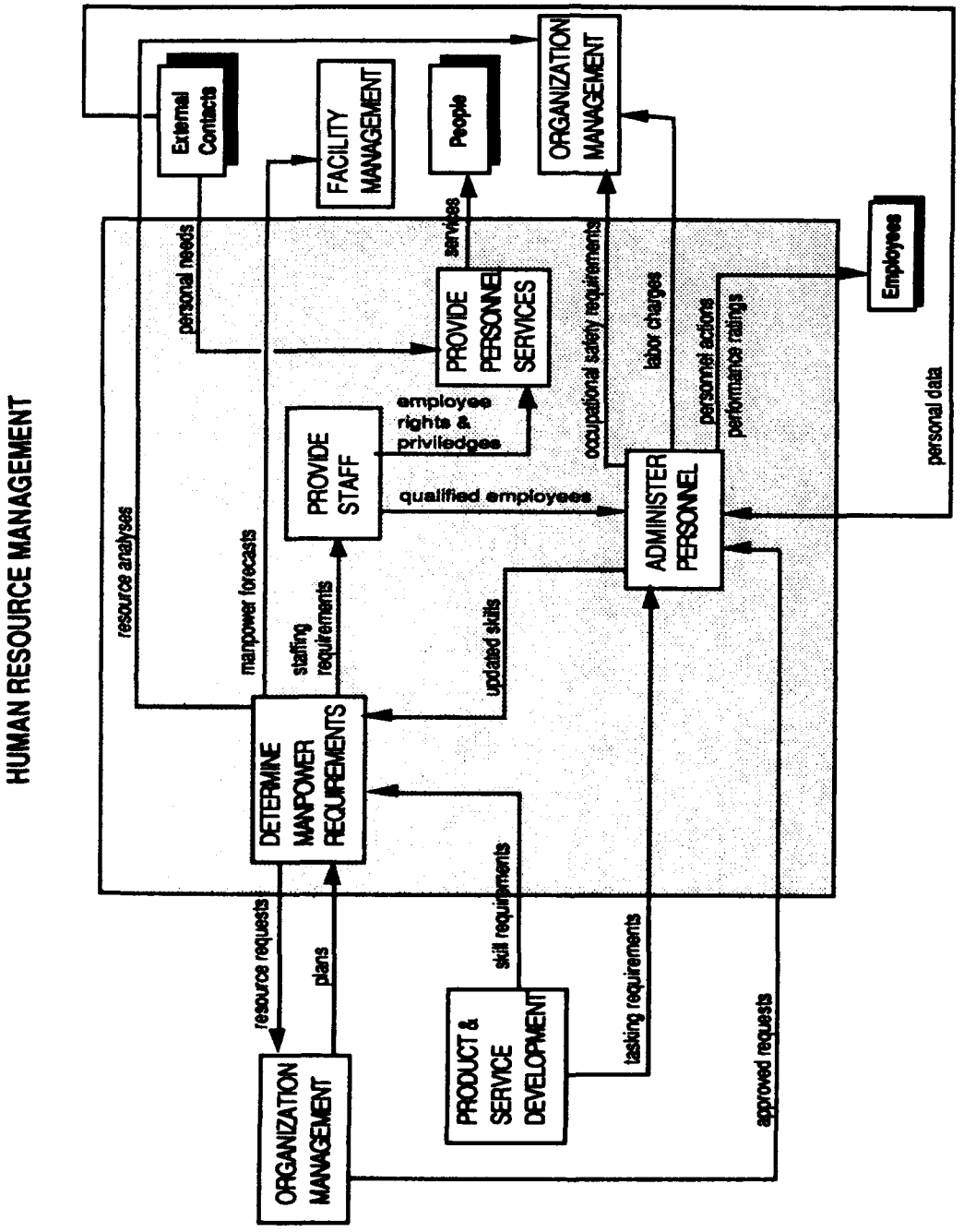
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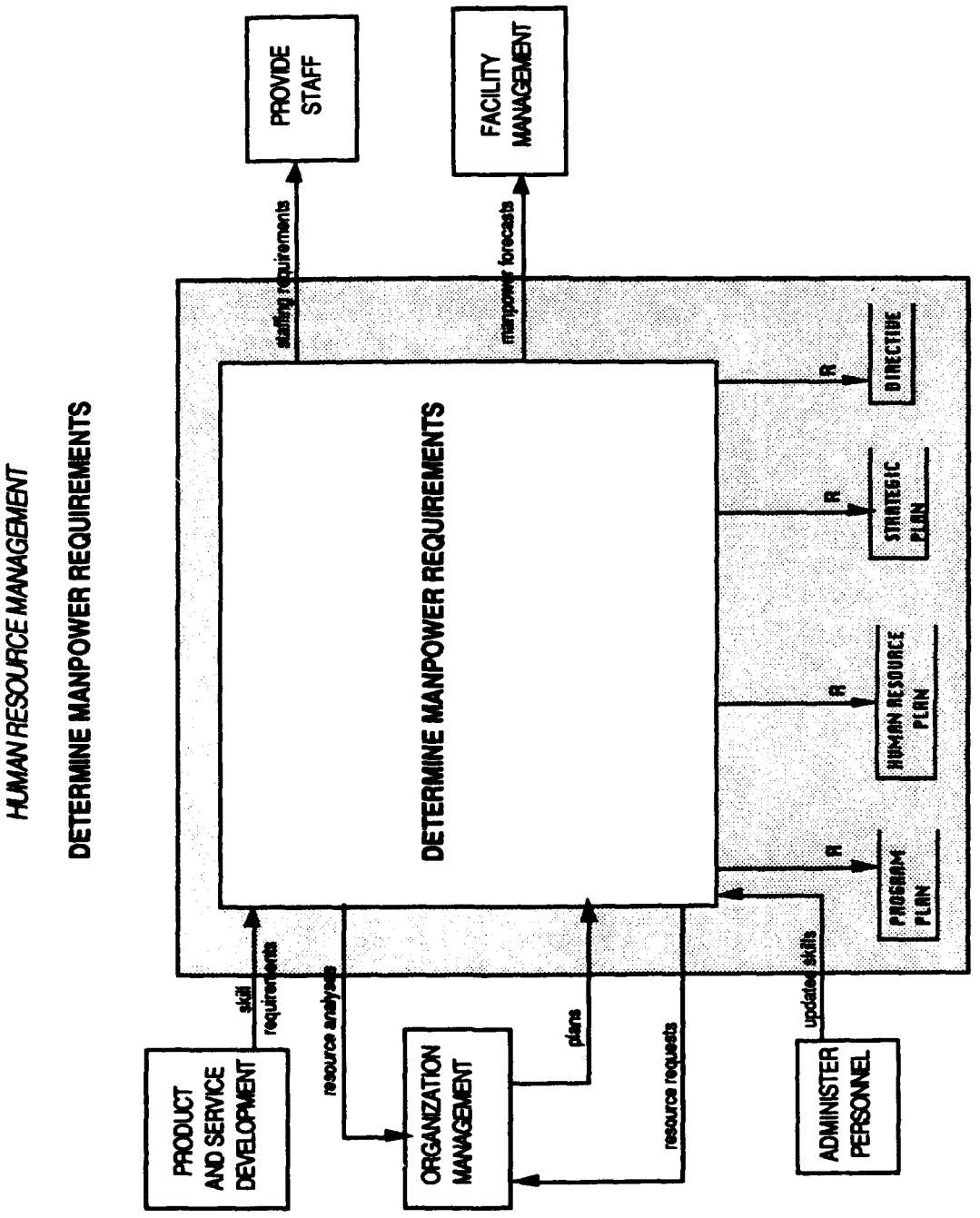
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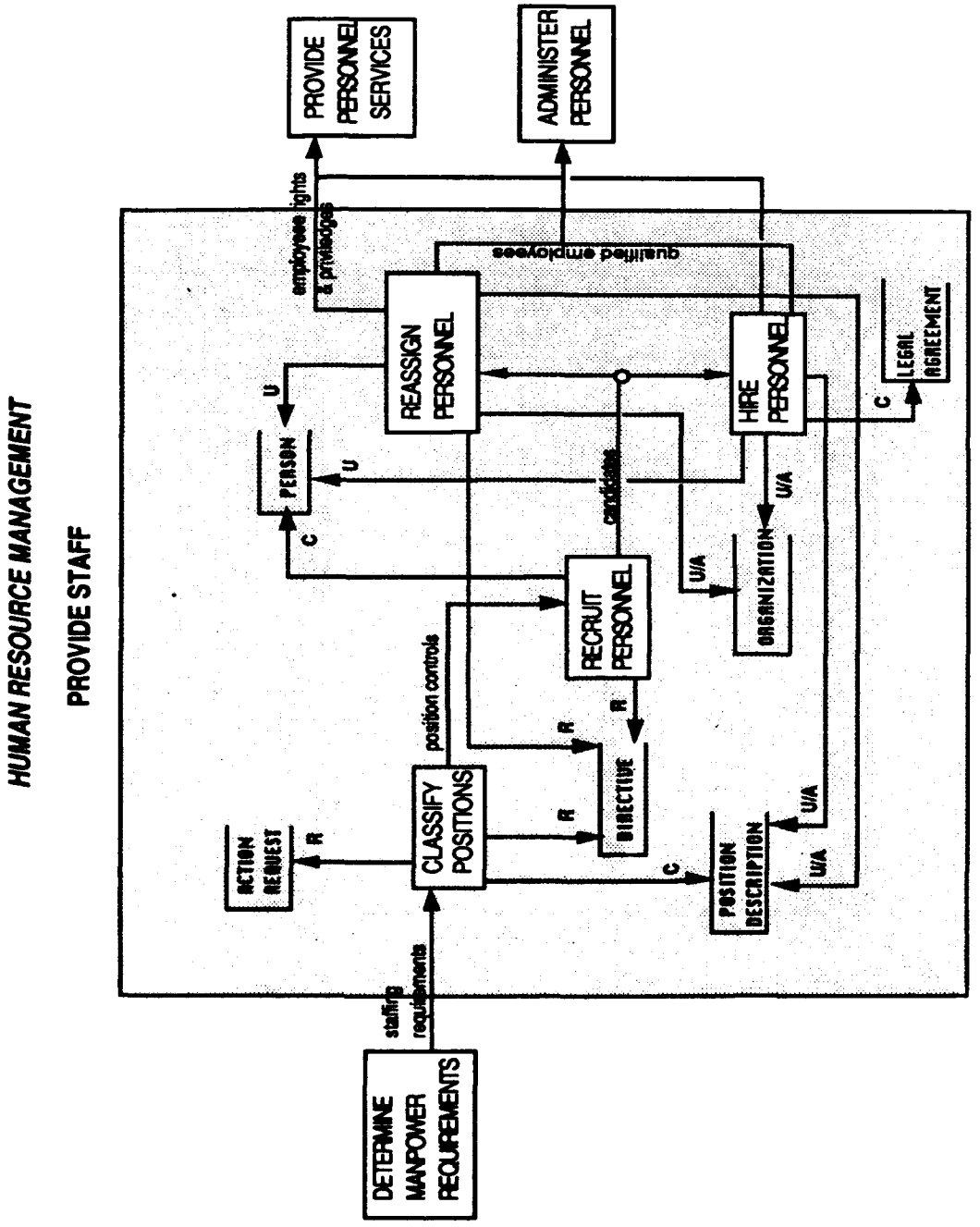
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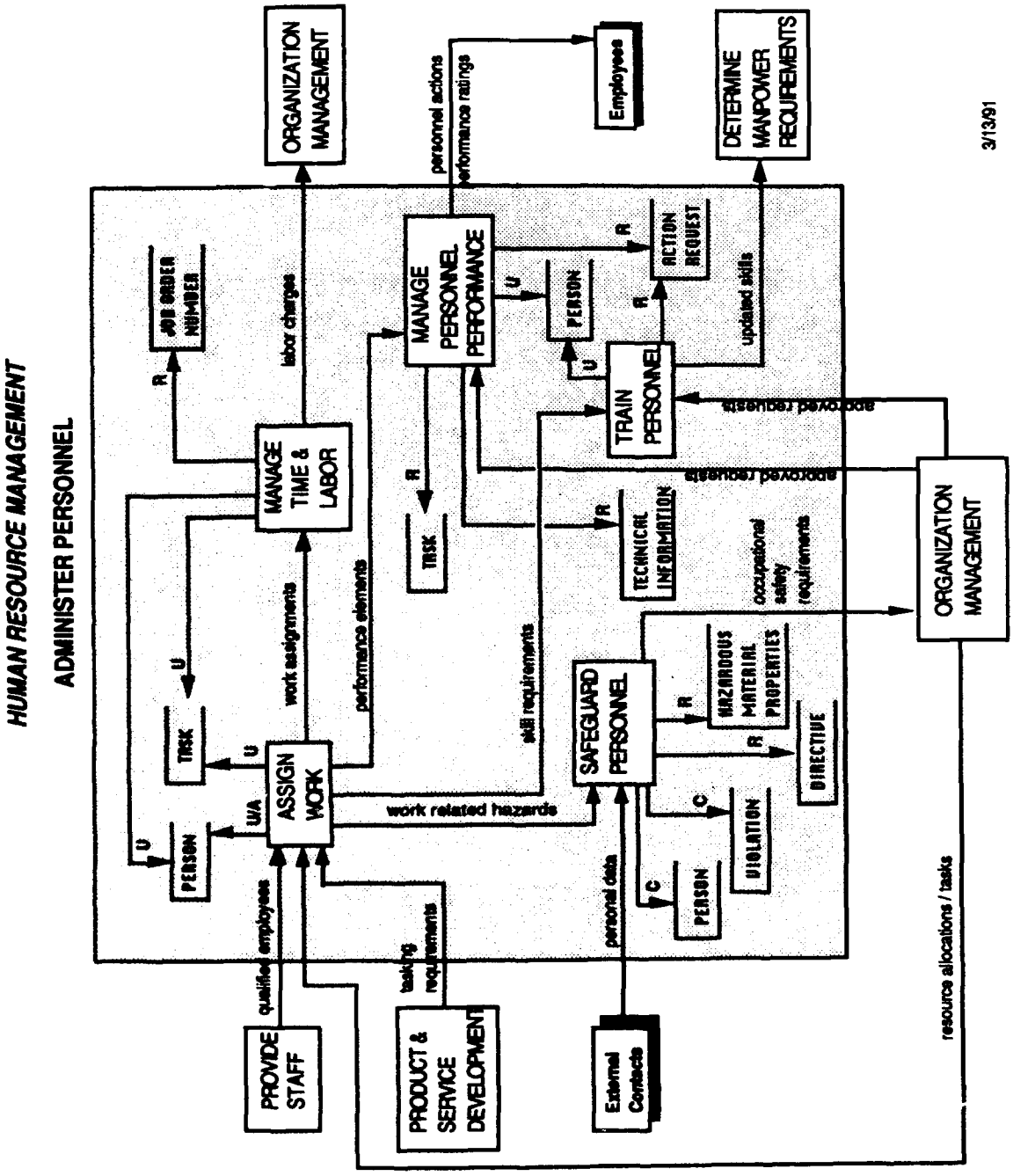
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PERSON
updated skills
TRAIN PERSONNEL
approved requests
MANAGE TIME & LABOR
TASK
TECHNICAL INFORMATION
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work assignments
performance elements
skill requirements
ASSIGN WORK
SAFEGUARD PERSONNEL
HAZARDOUS MATERIAL PROPERTIES
DIRECTIVE
work related hazards
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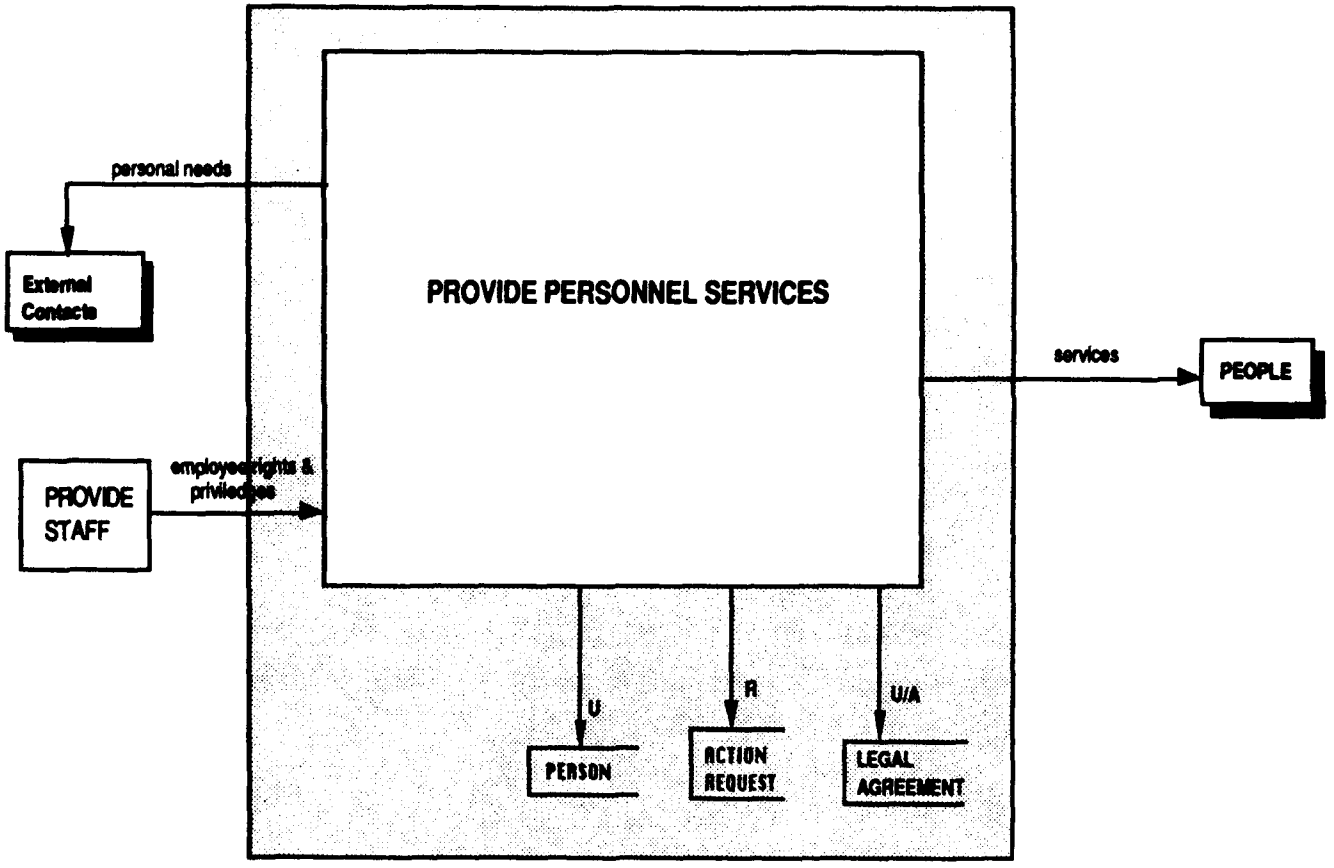
External Contacts
resource allocations / tasks

PROVIDE PERSONNEL SERVICES



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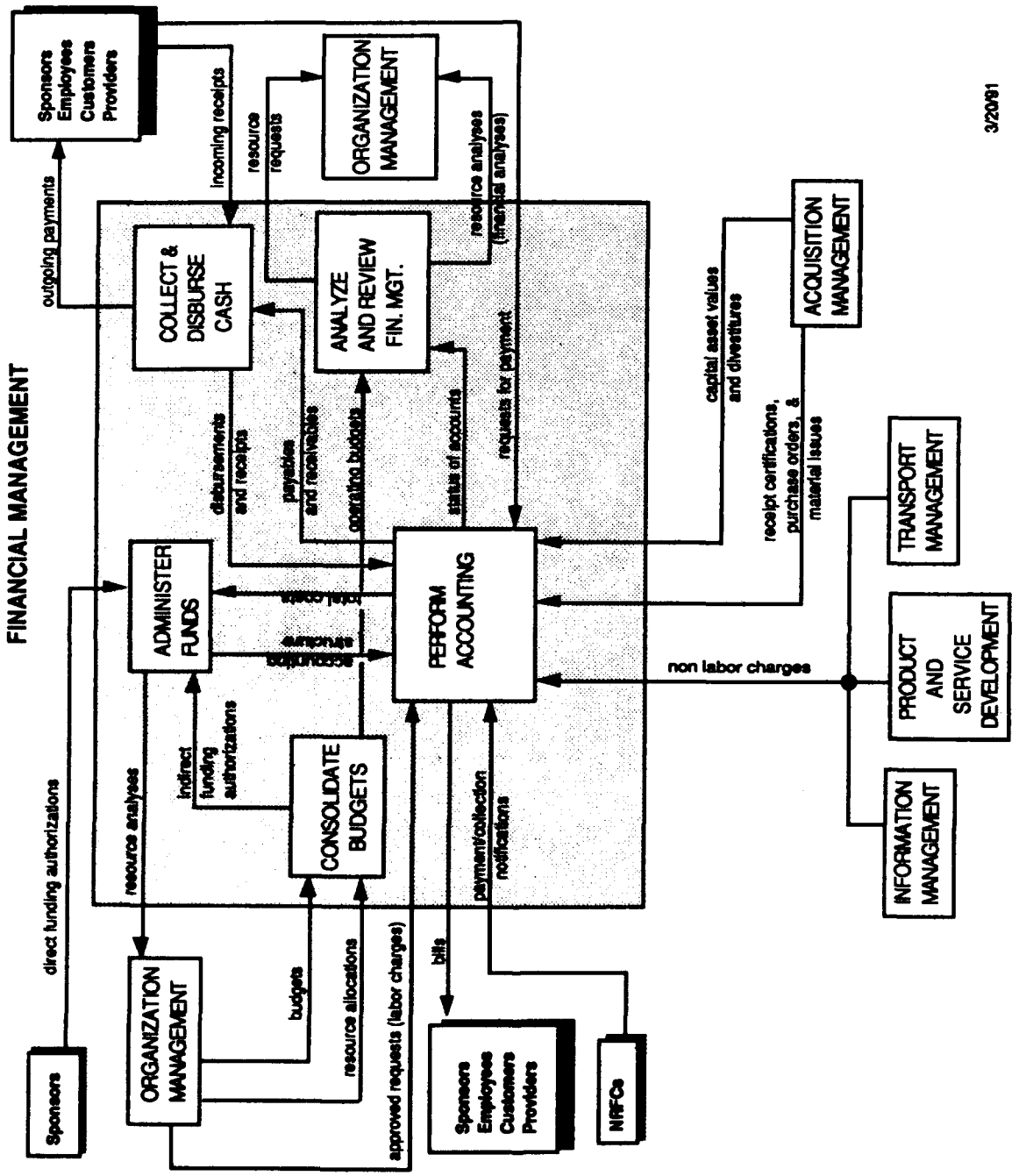
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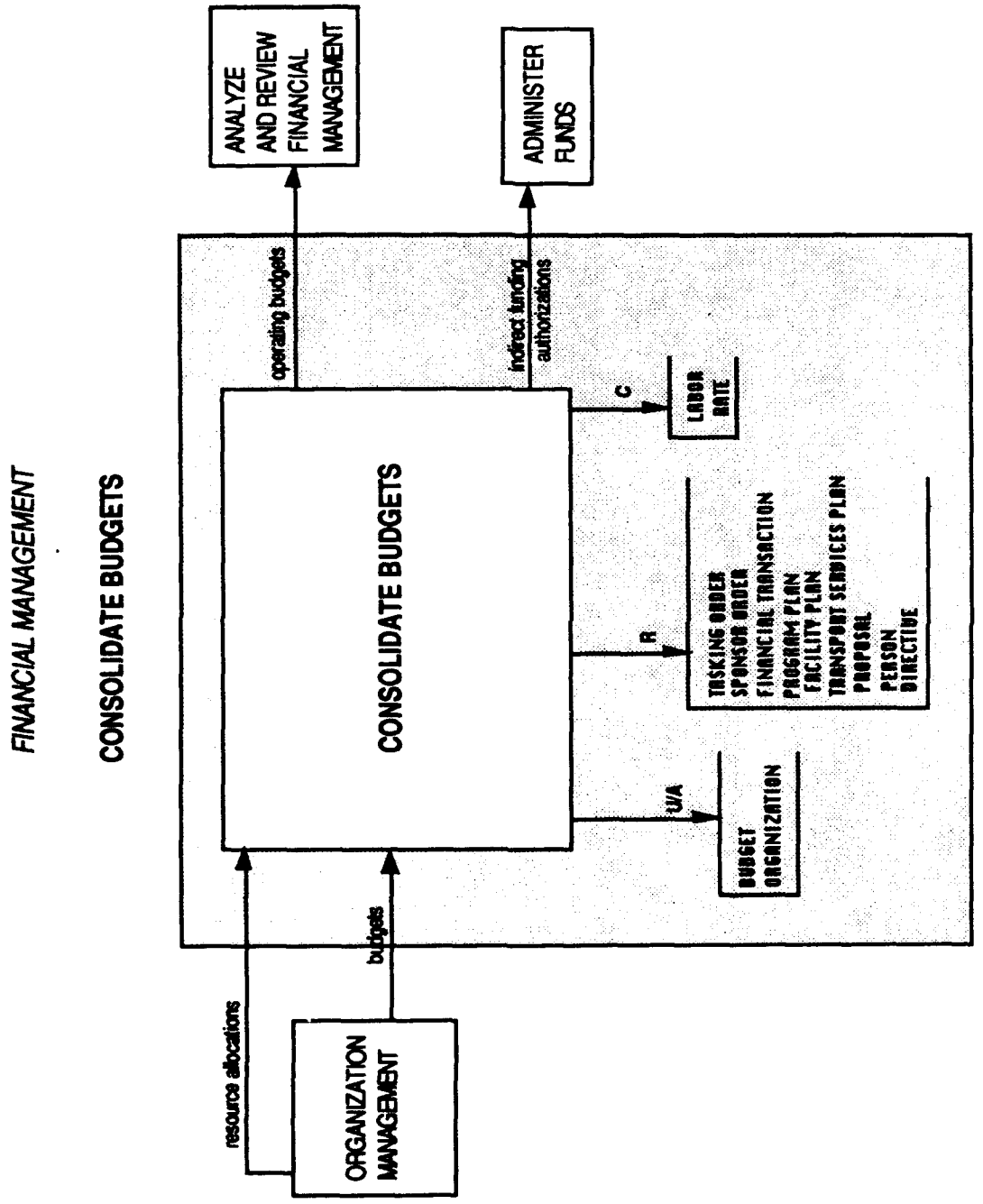
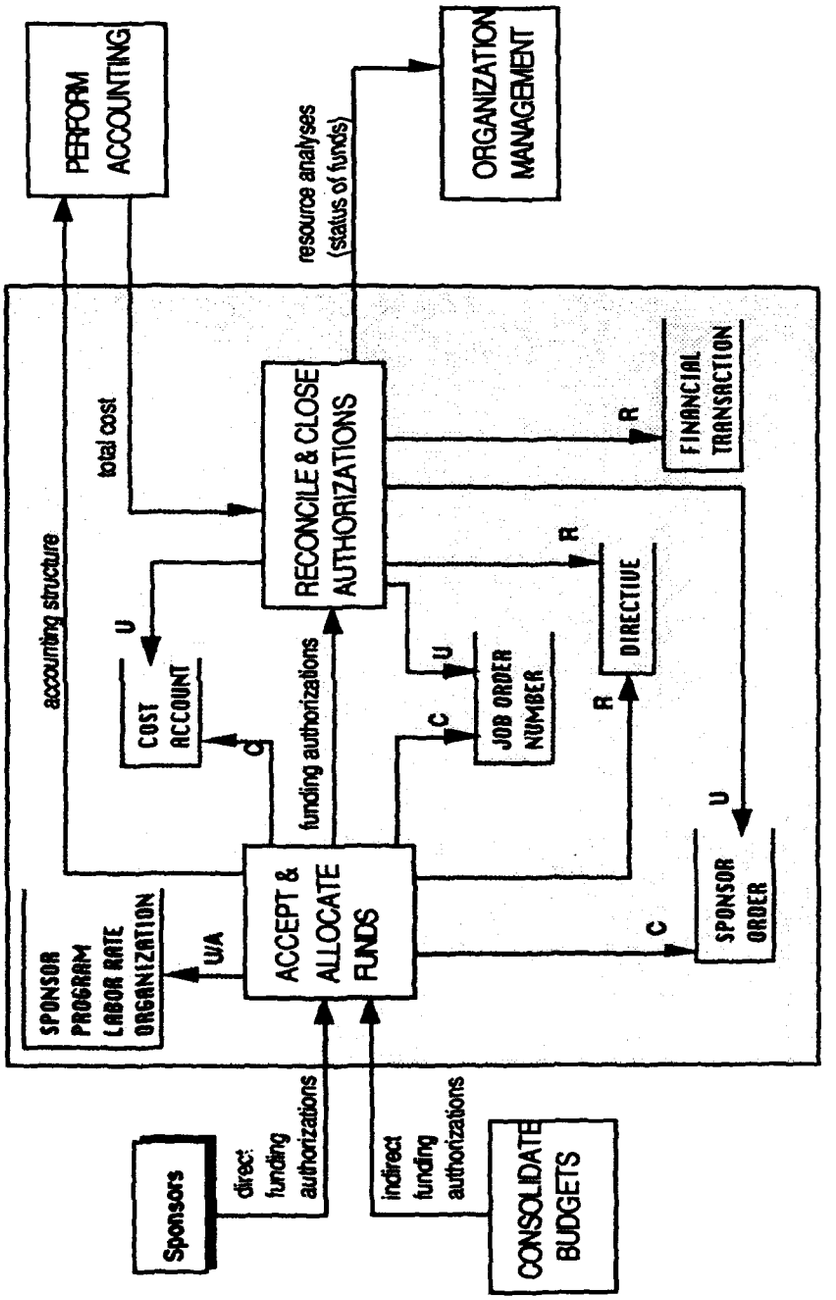
Employees
Customers
Providers
ORGANIZATION MANAGEMENT
COLLECT & DISBURSE CASH
ANALYZE AND REVIEW FIN. MGT.
ACQUISITION MANAGEMENT
TRANSPORT MANAGEMENT
PRODUCT AND SERVICE DEVELOPMENT
INFORMATION MANAGEMENT
ADMINISTER FUNDS
PERFORM ACCOUNTING
CONSOLIDATE BUDGETS
ORGANIZATION MANAGEMENT
Sponsors
Employees
Customers
Providers
NRFCs
incoming receipts
outgoing payments
resource requests
resource analyses (financial analyses)
disbursements and receipts
payables and receivables
operating budgets
status of accounts
requests for payment
capital asset values and divestitures
receipt certifications, purchase orders, & material issues
non labor charges
direct funding authorizations
resource analyses
indirect funding authorizations
budgets
resource allocations
approved requests (labor charges)
bills
payment/collection notifications
3/20/91


FINANCIAL MANAGEMENT
CONSOLIDATE BUDGETS
CONSOLIDATE BUDGETS
ANALYZE AND REVIEW FINANCIAL MANAGEMENT
ADMINISTER FUNDS
operating budgets
indirect funding authorizations
C
LABOR RATE
R
TASKING ORDER
SPONSOR ORDER
FINANCIAL TRANSACTION
PROGRAM PLAN
FACILITY PLAN
TRANSPORT SERVICES PLAN
PROPOSAL
PERSON DIRECTIVE
U/A
BUDGET ORGANIZATION
budgets
resource allocations
ORGANIZATION MANAGEMENT
3/20/91

FINANCIAL MANAGEMENT

ADMINISTER FUNDS



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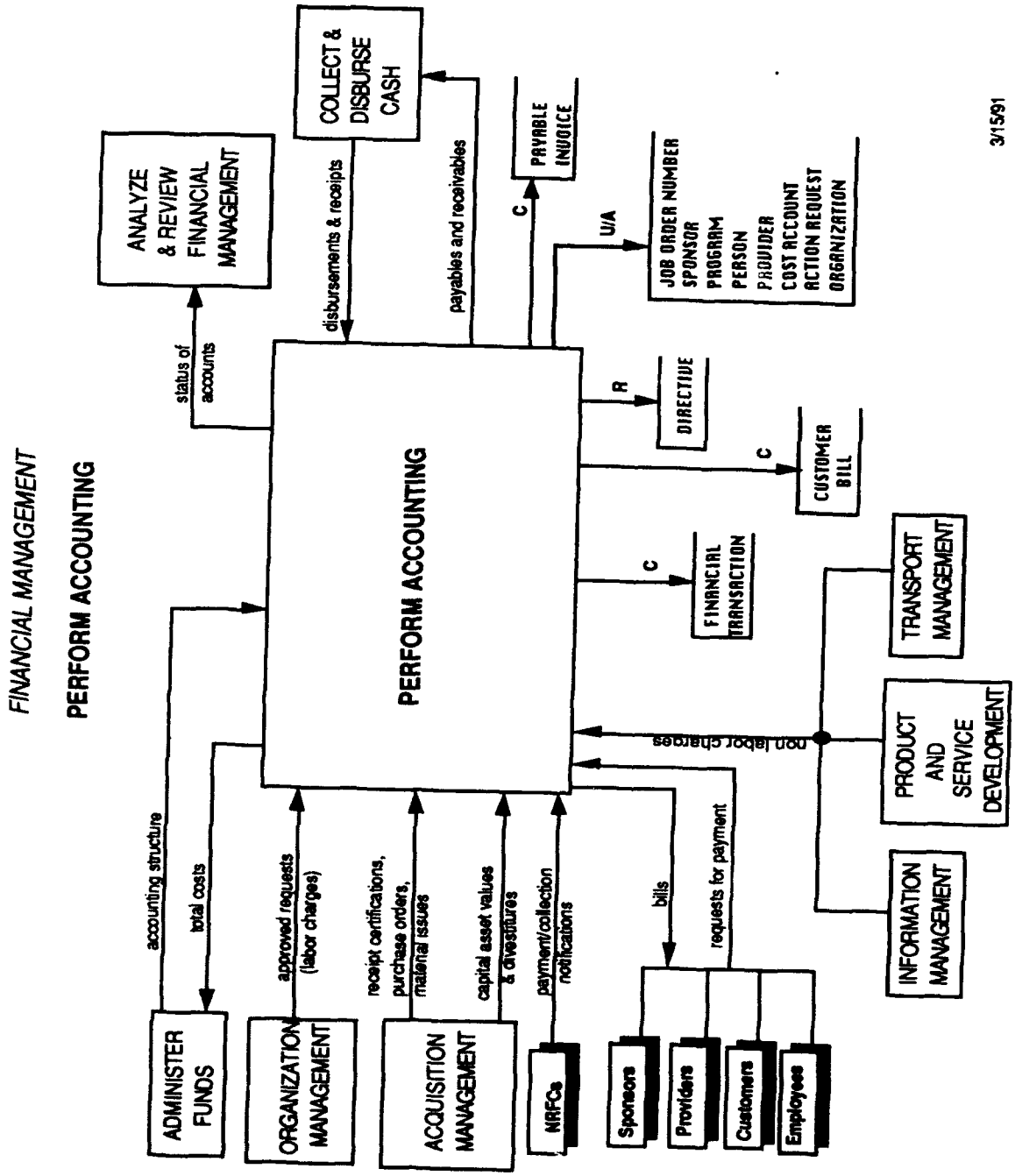
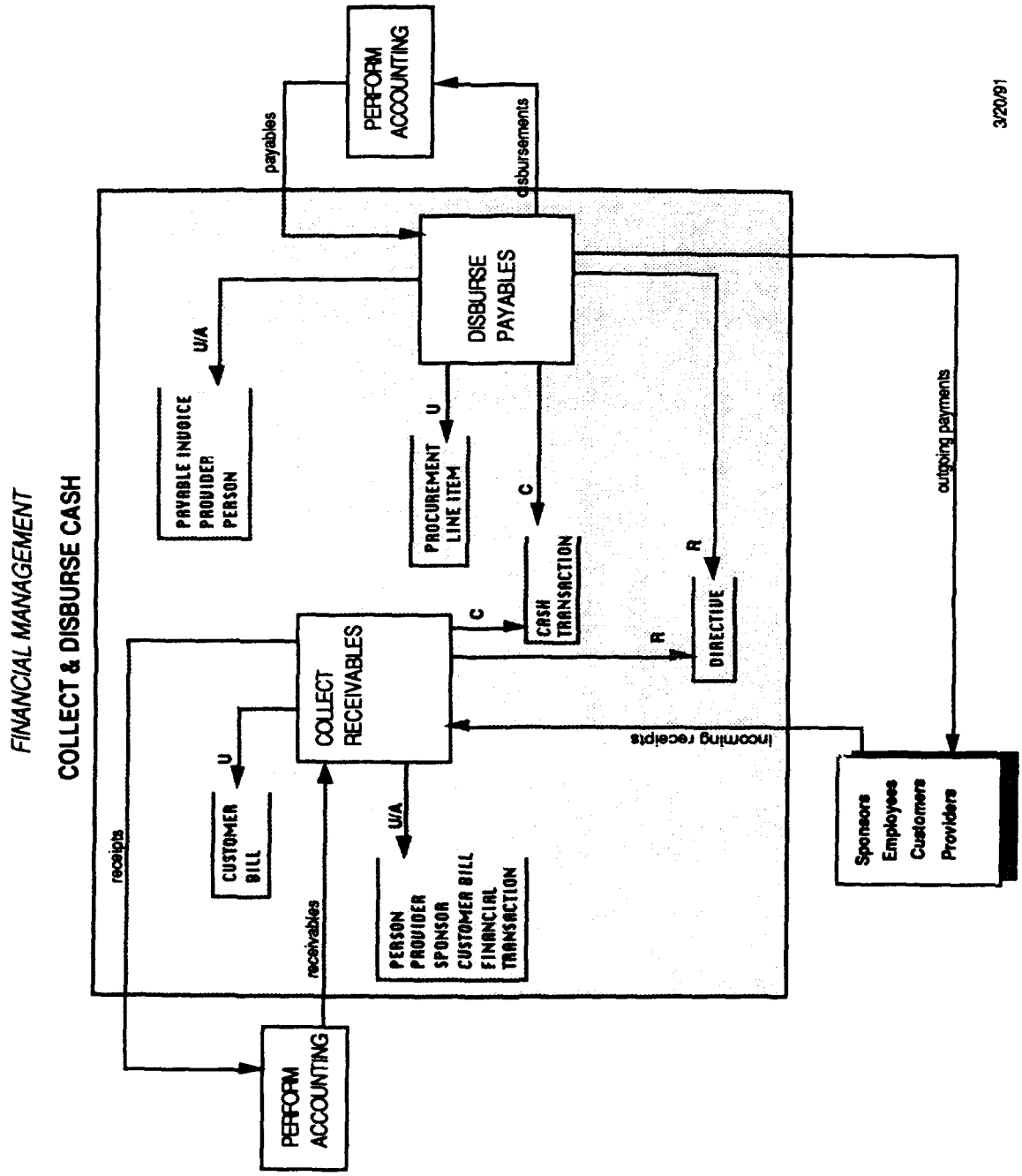

FINANCIAL MANAGEMENT
PERFORM ACCOUNTING
3/15/91
PERFORM ACCOUNTING
ANALYZE & REVIEW FINANCIAL MANAGEMENT
COLLECT & DISBURSE CASH
PAYABLE INVOICE
JOB ORDER NUMBER
SPONSOR
PROGRAM
PERSON
PROVIDER
COST ACCOUNT
ACTION REQUEST
ORGANIZATION
U/A
C
R
DIRECTIVE
CUSTOMER BILL
FINANCIAL TRANSACTION
TRANSPORT MANAGEMENT
PRODUCT AND SERVICE DEVELOPMENT
INFORMATION MANAGEMENT
non labor charges
status of accounts
disbursements & receipts
payables and receivables
accounting structure
total costs
approved requests (labor charges)
receipt certifications, purchase orders, material issues
capital asset values & divestitures
payment/collection notifications
bills
requests for payment
ADMINISTER FUNDS
ORGANIZATION MANAGEMENT
ACQUISITION MANAGEMENT
NAFCs
Sponsors
Providers
Customers
Employees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3/20/91
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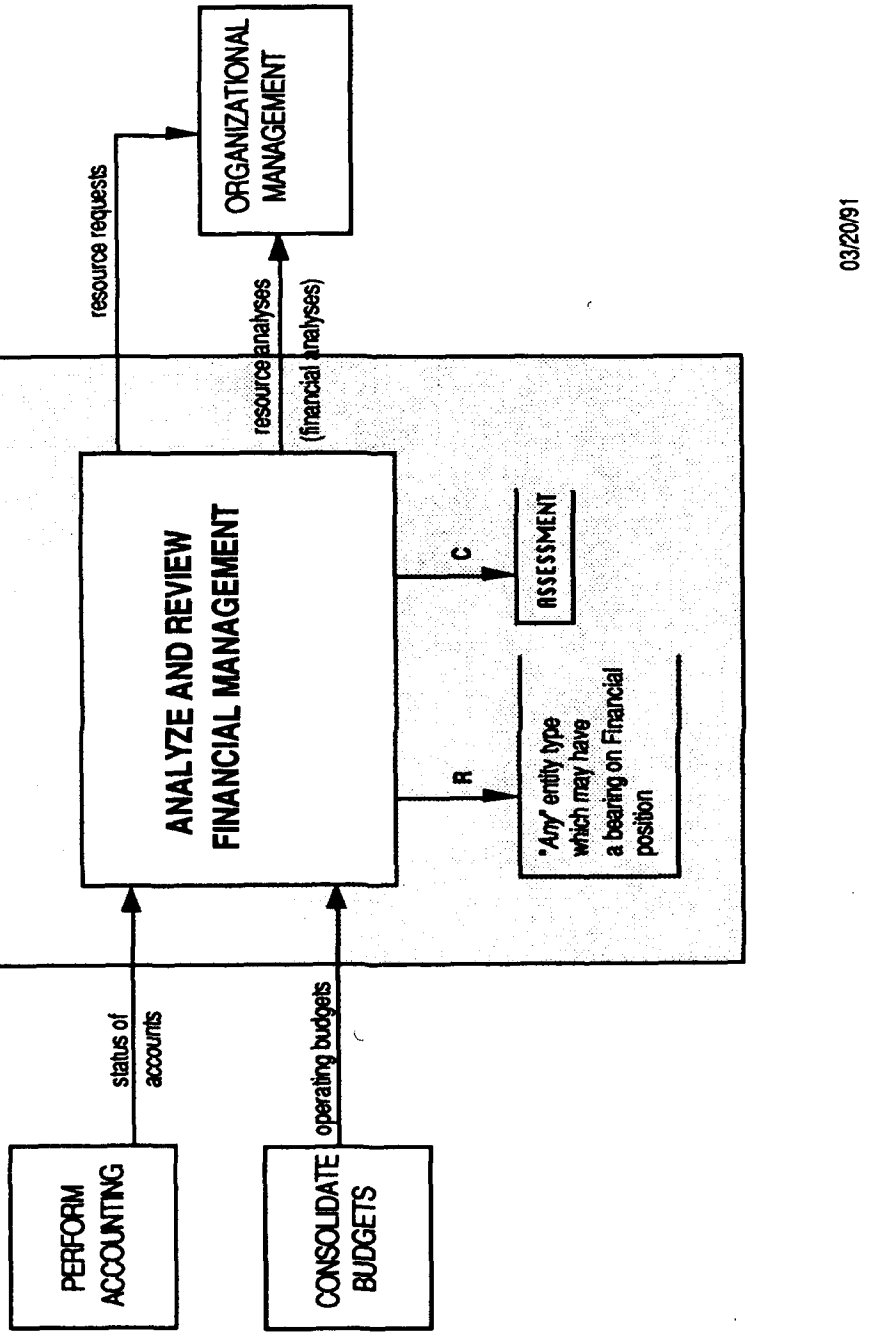
disbursements
DISBURSE PAYABLES
U/A
PAYABLE INVOICE
PROVIDER
PERSON
U
PROCUREMENT LINE ITEM
C
CASH TRANSACTION
R
DIRECTIVE
outgoing payments
C
COLLECT RECEIVABLES
R
incoming receipts
U
CUSTOMER BILL
U/A
PERSON
PROVIDER
SPONSOR
CUSTOMER BILL
FINANCIAL TRANSACTION
receipts
receivables
Sponsors
Employees
Customers
Providers
PERFORM ACCOUNTING

FINANCIAL MANAGEMENT

ANALYZE AND REVIEW FINANCIAL MANAGEMENT



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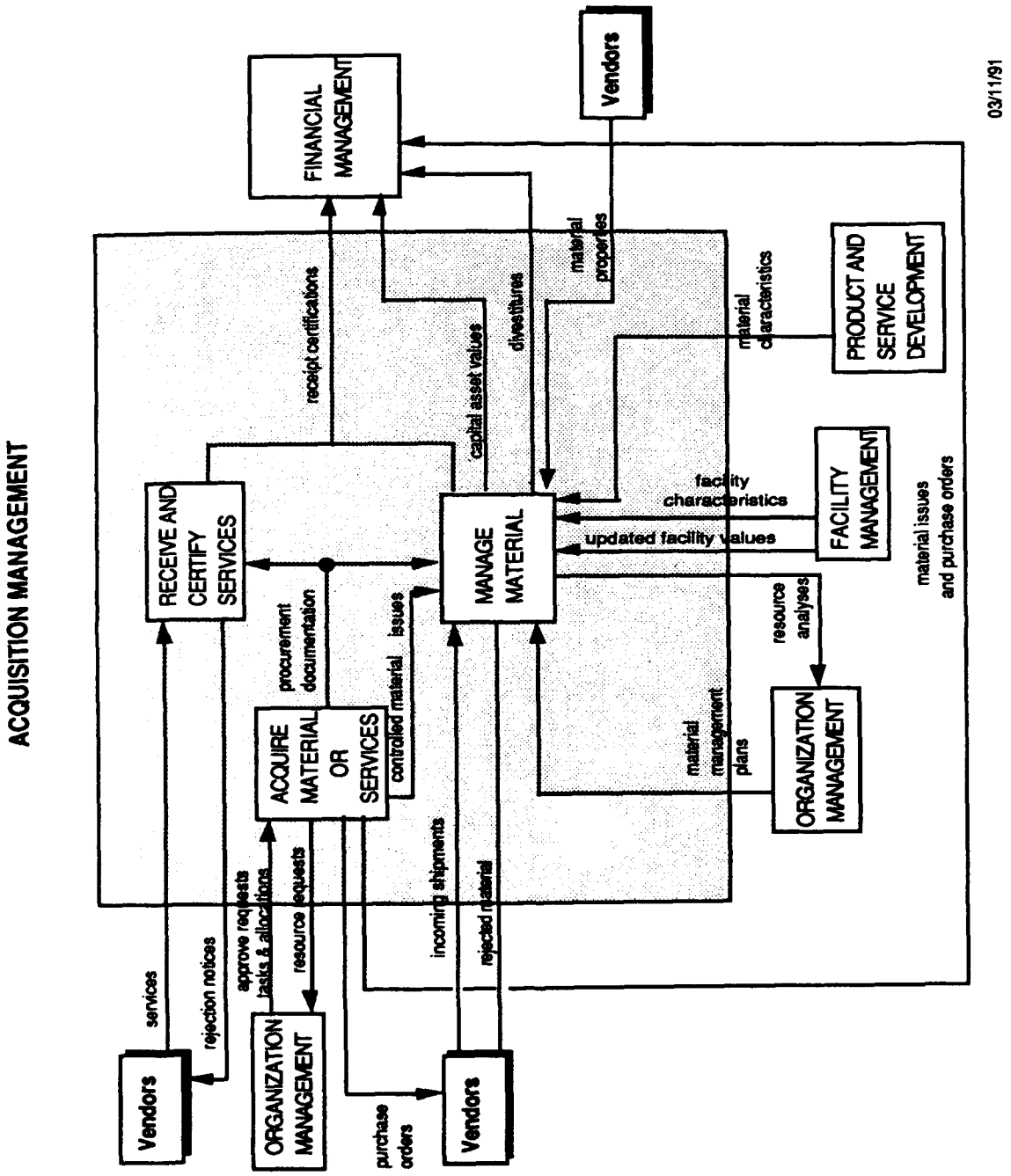
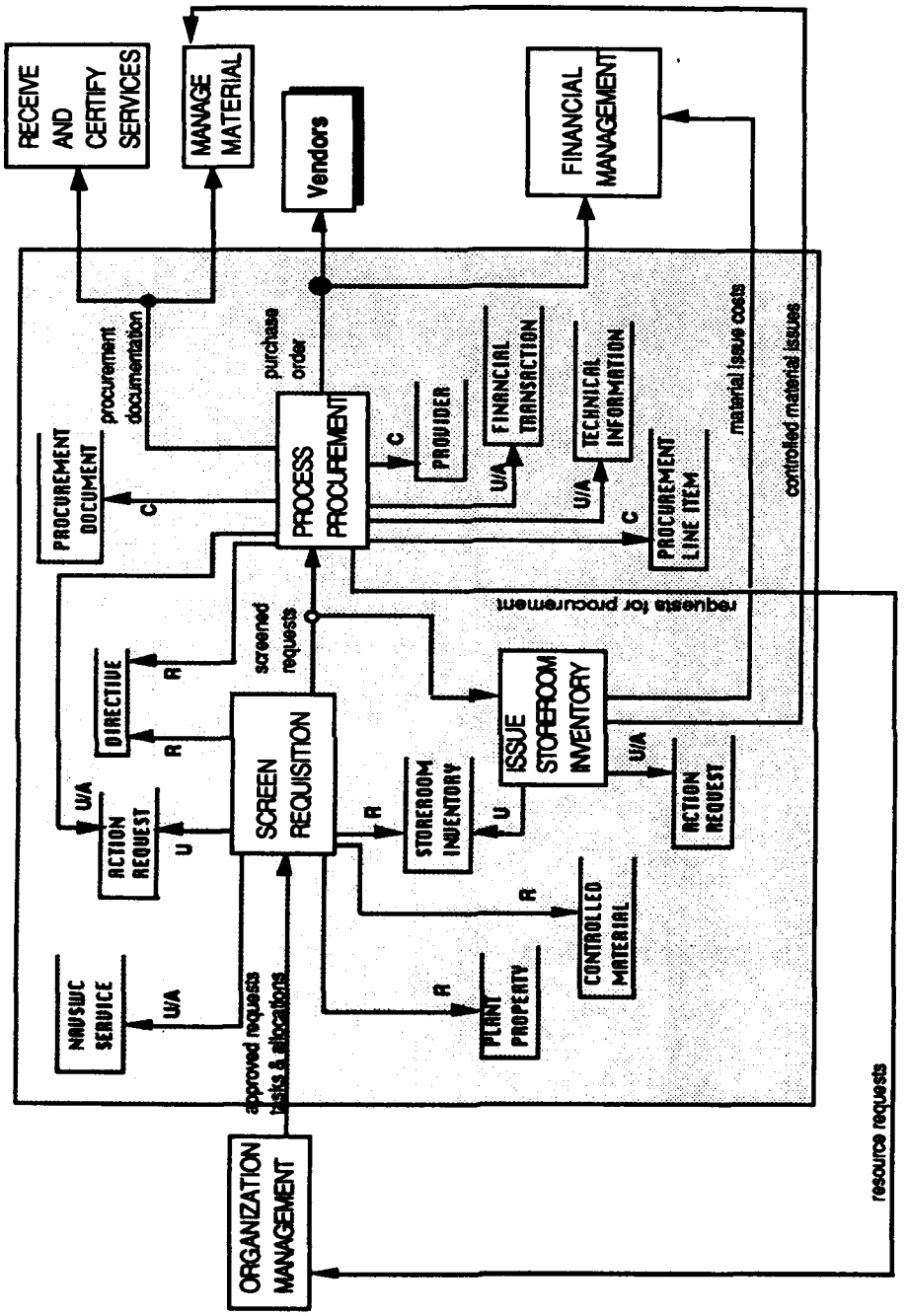

ACQUISITION MANAGEMENT
FINANCIAL MANAGEMENT
Vendors
receipt certifications
capital asset values
divestitures
material properties
material characteristics
PRODUCT AND SERVICE DEVELOPMENT
facility characteristics
updated facility values
FACILITY MANAGEMENT
material issues and purchase orders
RECEIVE AND CERTIFY SERVICES
MANAGE MATERIAL
procurement documentation
issues
controlled material
ACQUIRE MATERIAL OR SERVICES
resource analyses
material management plans
ORGANIZATION MANAGEMENT
approve requests
tasks & allocations
resource requests
incoming shipments
rejected material
services
rejection notices
purchase orders
Vendors
ORGANIZATION MANAGEMENT
Vendors
03/11/91

ACQUISITION MANAGEMENT

ACQUIRE MATERIAL OR SERVICES



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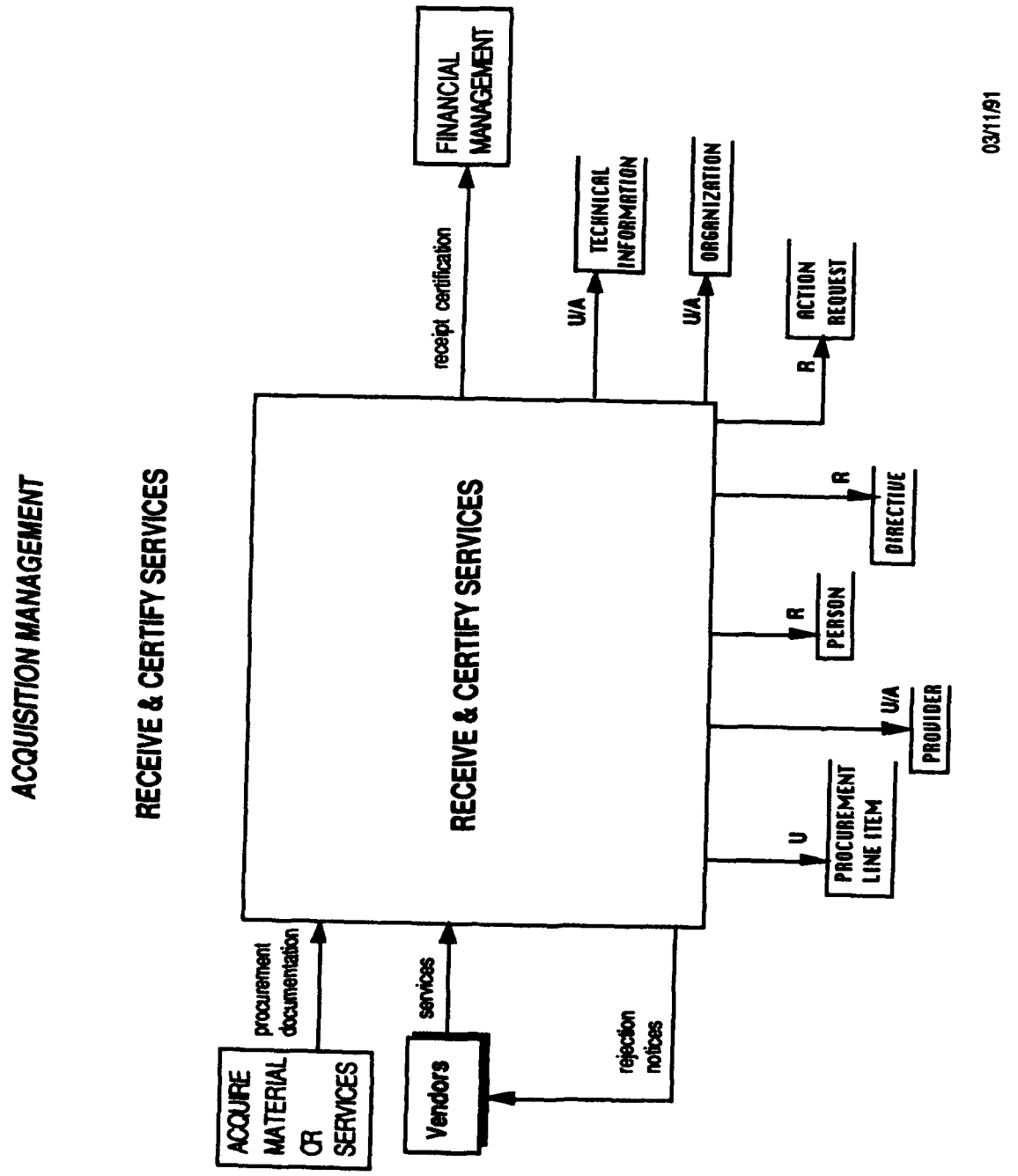
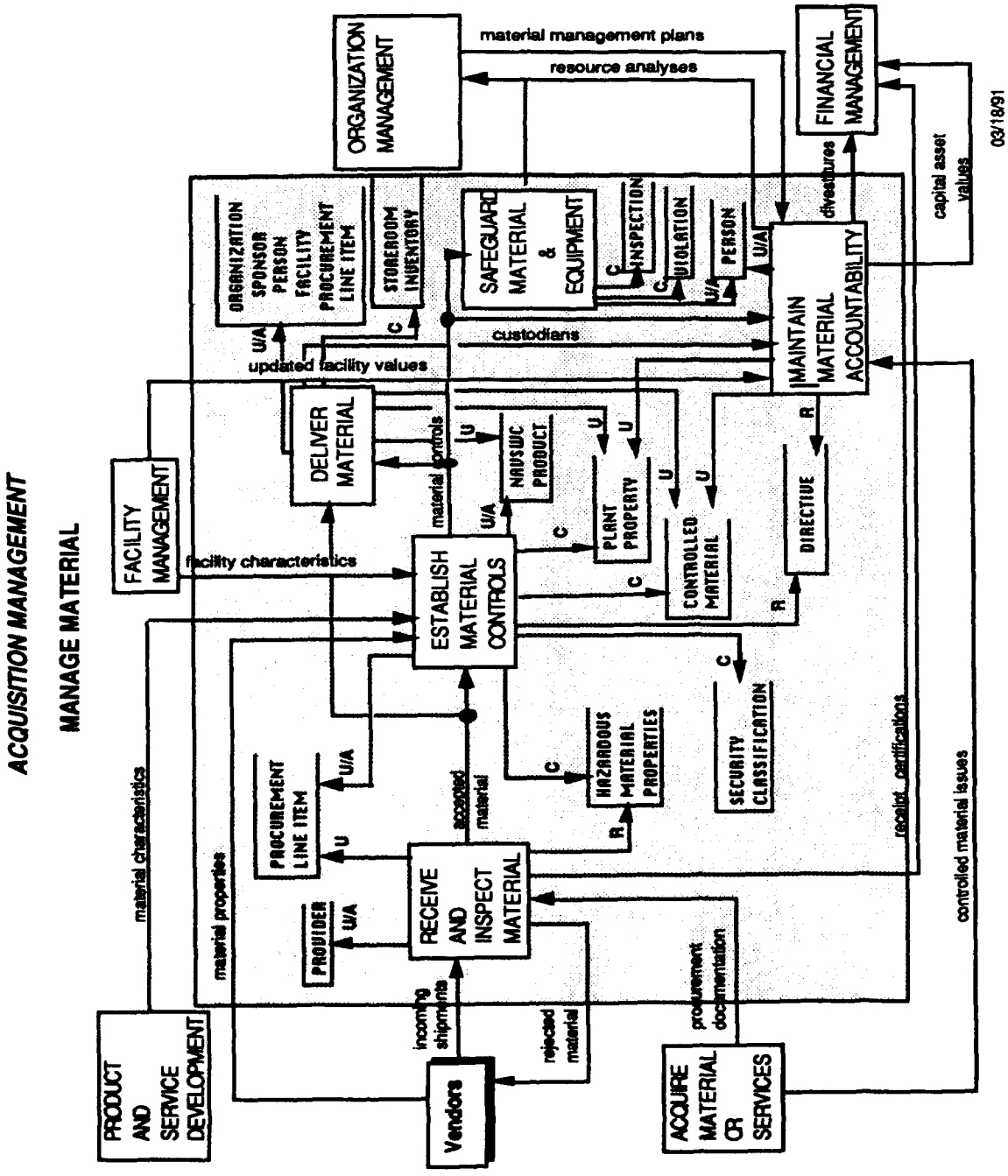

ACQUISITION MANAGEMENT
RECEIVE & CERTIFY SERVICES
RECEIVE & CERTIFY SERVICES
ACQUIRE MATERIAL OR SERVICES
Vendors
procurement documentation
services
rejection notices
receipt certification
FINANCIAL MANAGEMENT
U/A
TECHNICAL INFORMATION
U/A
ORGANIZATION
R
ACTION REQUEST
R
DIRECTIVE
R
PERSON
U/A
PROVIDER
U
PROCUREMENT LINE ITEM
03/11/91


ACQUISITION MANAGEMENT
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ORGANIZATION MANAGEMENT
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resource analyses
FINANCIAL MANAGEMENT
divestitures
capital asset values
03/18/91
ORGANIZATION
SPONSOR
PERSON
FACILITY
PROCUREMENT LINE ITEM
STOREROOM INVENTORY
SAFEGUARD MATERIAL & EQUIPMENT
INSPECTION
VIOLATION
PERSON
MAINTAIN MATERIAL ACCOUNTABILITY
custodians
updated facility values
DELIVER MATERIAL
material controls
NAUSUC PRODUCT
PLANT PROPERTY
CONTROLLED MATERIAL
DIRECTIVE
FACILITY MANAGEMENT
facility characteristics
ESTABLISH MATERIAL CONTROLS
HAZARDOUS MATERIAL PROPERTIES
SECURITY CLASSIFICATION
material characteristics
material properties
PROCUREMENT LINE ITEM
PROVIDER
accepted material
RECEIVE AND INSPECT MATERIAL
receipt certifications
controlled material issues
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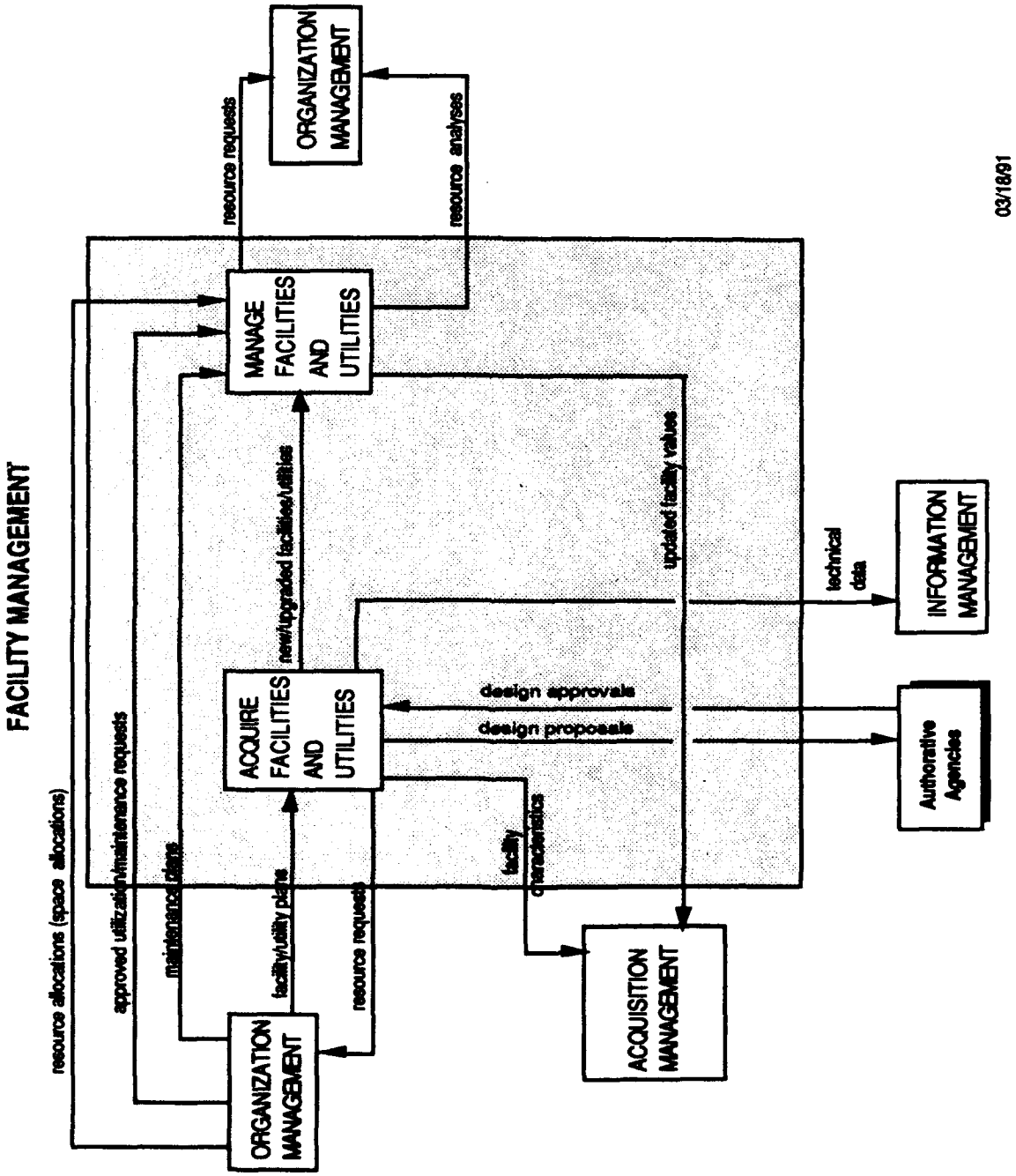
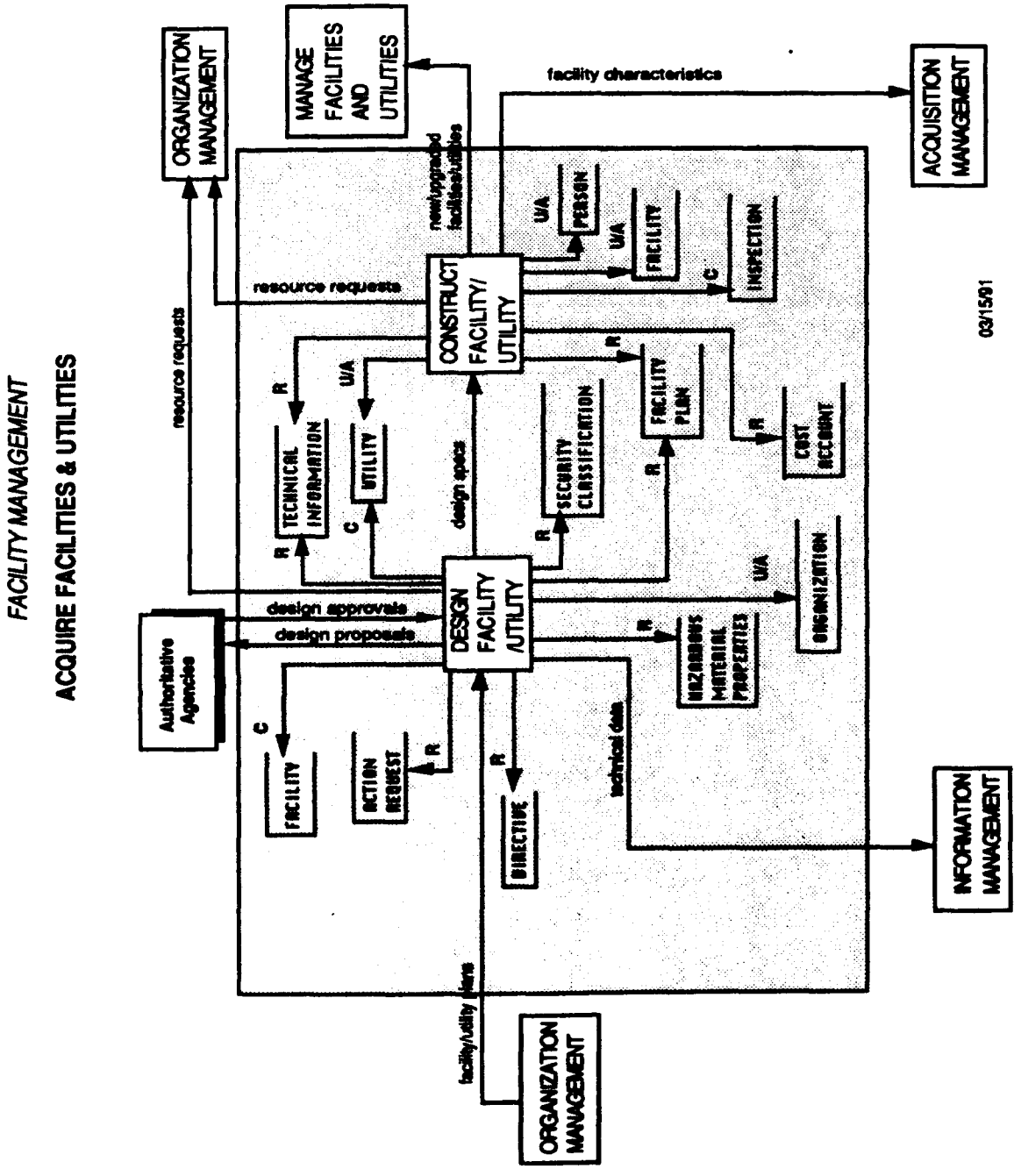
procurement documentation
PRODUCT AND SERVICE DEVELOPMENT
Vendors
ACQUIRE MATERIAL OR SERVICES


FACILITY MANAGEMENT
ORGANIZATION MANAGEMENT
resource requests
resource analyses
MANAGE FACILITIES AND UTILITIES
new/upgraded facilities/utilities
updated facility values
technical data
INFORMATION MANAGEMENT
ACQUIRE FACILITIES AND UTILITIES
design approvals
design proposals
Authorative Agencies
facility characteristics
resource allocations (space allocations)
approved utilization/maintenance requests
maintenance plans
facility/utility plans
resource requests
ORGANIZATION MANAGEMENT
ACQUISITION MANAGEMENT
03/18/91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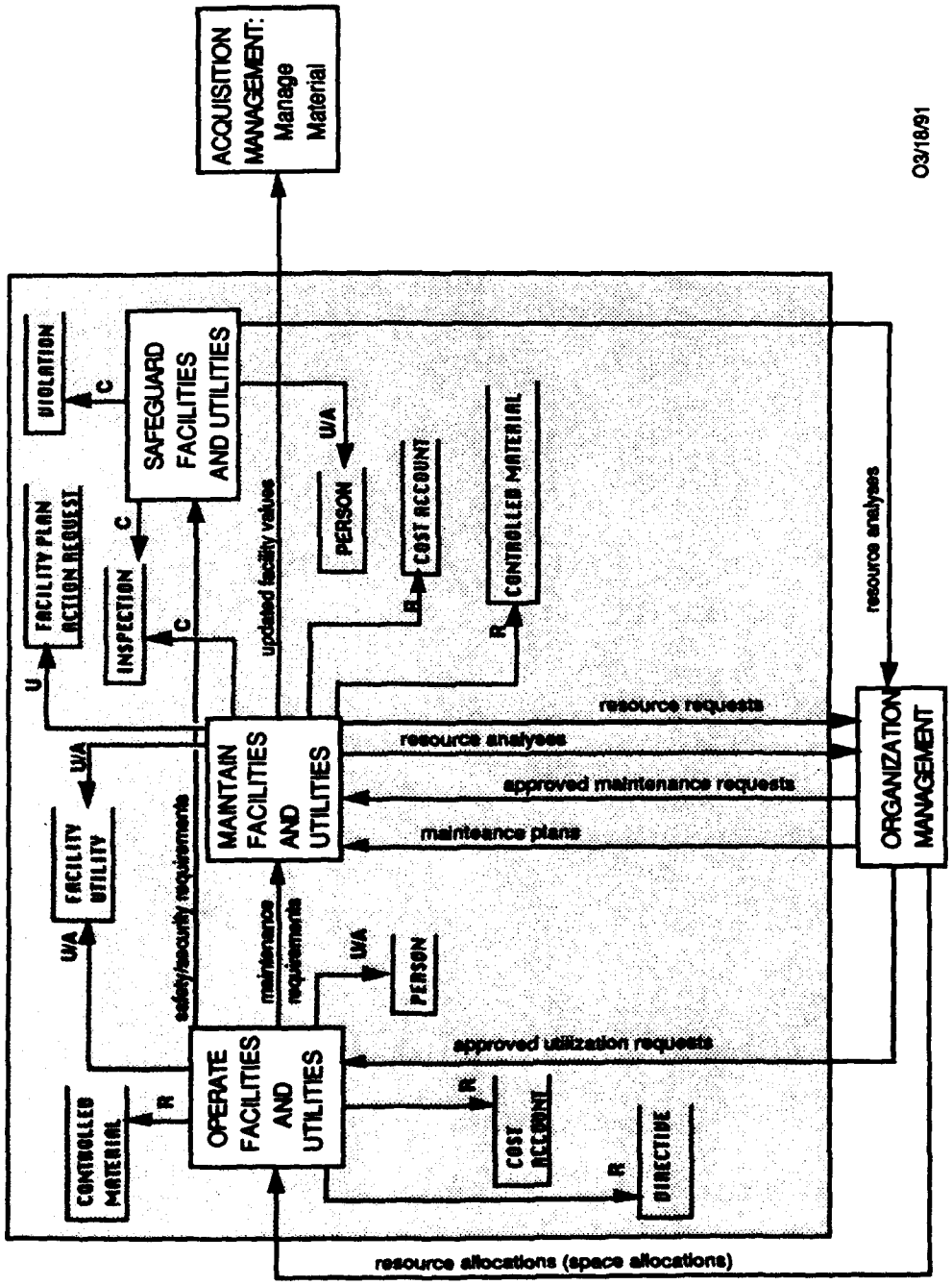
ORGANIZATION MANAGEMENT
MANAGE FACILITIES AND UTILITIES
ACQUISITION MANAGEMENT
facility characteristics
new/upgraded facilities/utilities
resource requests
CONSTRUCT FACILITY/ UTILITY
U/A
PERSON
FACILITY
INSPECTION
C
R
TECHNICAL INFORMATION
UTILITY
design specs
SECURITY CLASSIFICATION
FACILITY PLAN
COST ACCOUNT
DESIGN FACILITY /UTILITY
design approvals
design proposals
Authoritative Agencies
HAZARDOUS MATERIAL PROPERTIES
ORGANIZATION
ACTION REQUEST
DIRECTIVE
technical data
INFORMATION MANAGEMENT
facility/utility plans
03/15/91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MANAGE FACILITIES & UTILITIES
03/18/91
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SAFEGUARD FACILITIES AND UTILITIES
VIOLATION
FACILITY PLAN ACTION REQUEST
INSPECTION
PERSON
COST ACCOUNT
CONTROLLED MATERIAL
updated facility values
resource analyses
resource requests
MAINTAIN FACILITIES AND UTILITIES
FACILITY UTILITY
approved maintenance requests
maintenance plans
ORGANIZATION MANAGEMENT
safety/security requirements
maintenance requirements
PERSON
OPERATE FACILITIES AND UTILITIES
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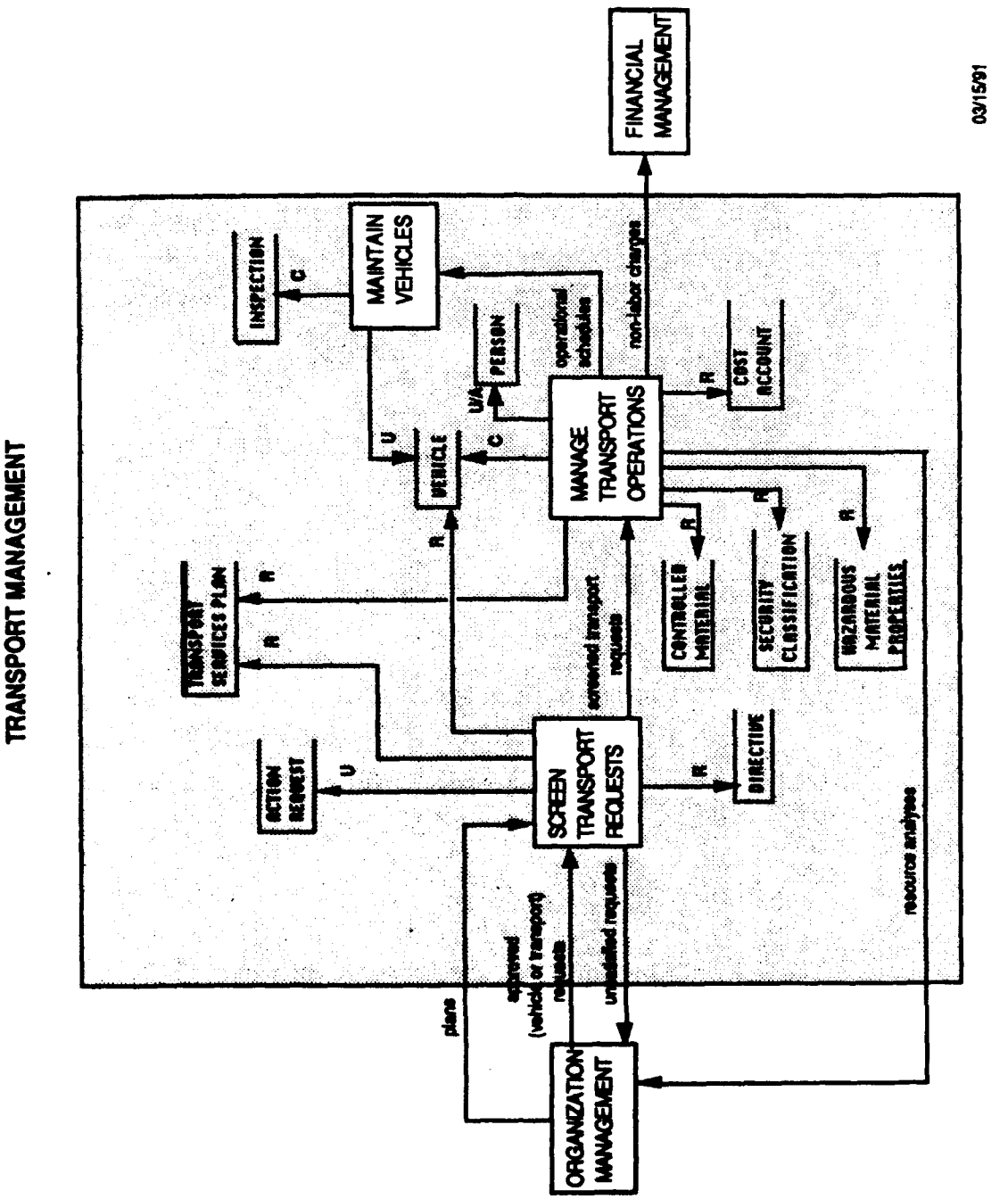
CONTROLLED MATERIAL
COST ACCOUNT
DIRECTIVE
resource allocations (space allocations)


TRANSPORT MANAGEMENT
03/15/91
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MAINTAIN VEHICLES
INSPECTION
C
MANAGE TRANSPORT OPERATIONS
PERSON
U/A
operational schedules
non-labor charges
COST ACCOUNT
R
VEHICLE
U
C
TRANSPORT SERVICES PLAN
R
CONTROLLED MATERIAL
SECURITY CLASSIFICATION
HAZARDOUS MATERIAL PROPERTIES
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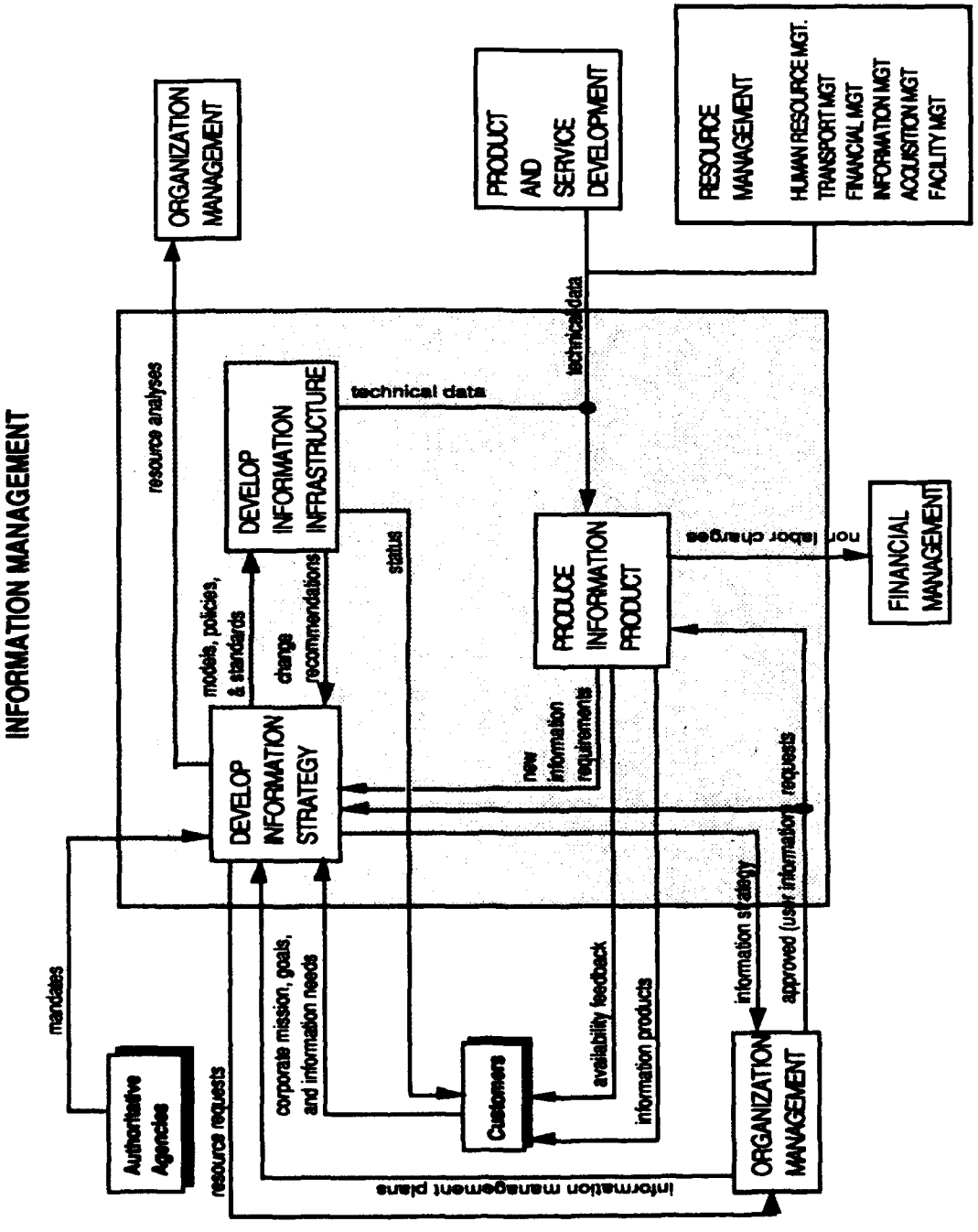
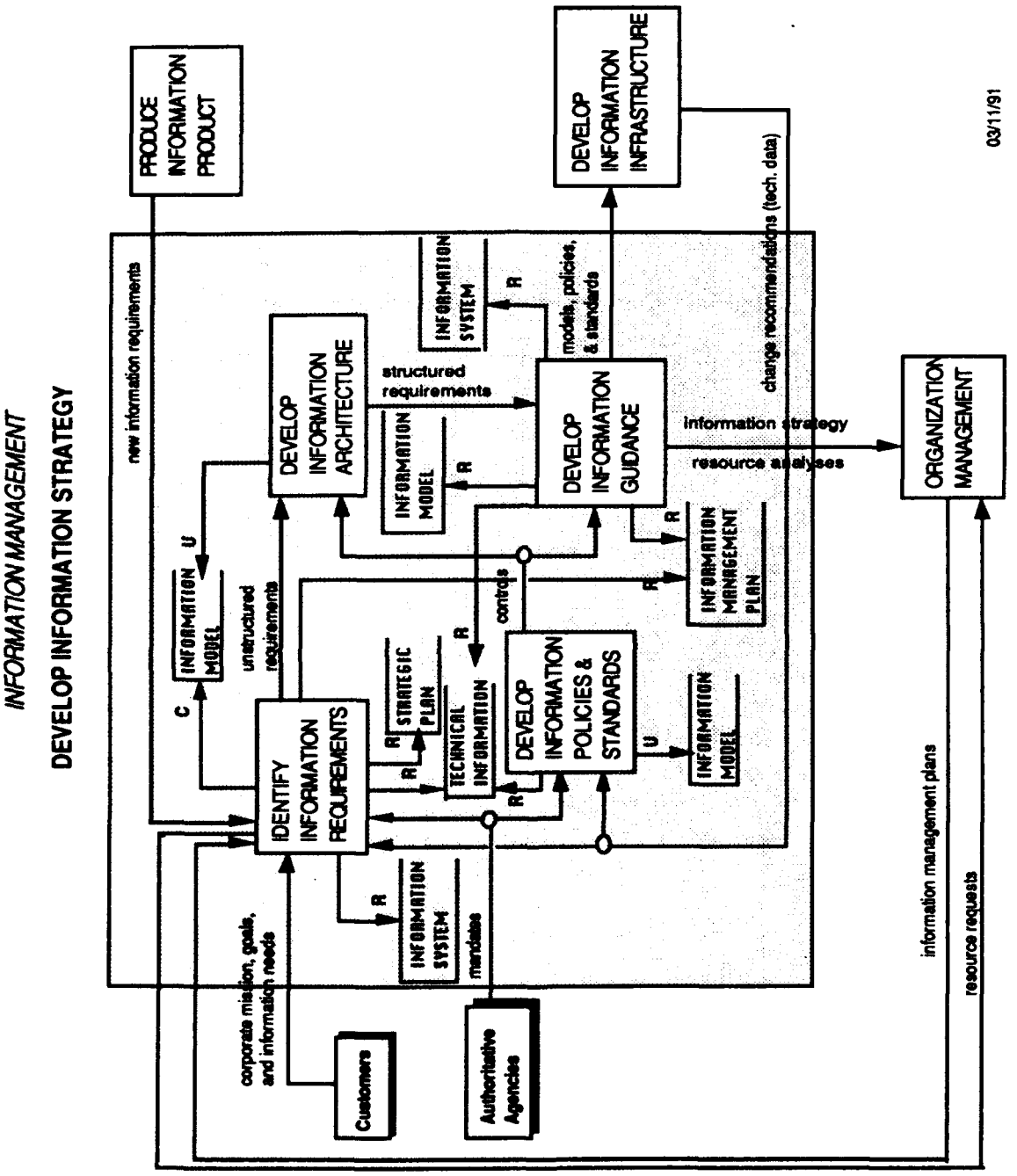
ACTION REQUEST
U
SCREEN TRANSPORT REQUESTS
DIRECTIVE
resource analyses
plans
approved (vehicle or transport) requests
unfulfilled requests
ORGANIZATION MANAGEMENT


INFORMATION MANAGEMENT
ORGANIZATION MANAGEMENT
PRODUCT AND SERVICE DEVELOPMENT
RESOURCE MANAGEMENT
HUMAN RESOURCE MGT.
TRANSPORT MGT
FINANCIAL MGT
INFORMATION MGT
ACQUISITION MGT
FACILITY MGT
03/04/91
technical data
resource analyses
DEVELOP INFORMATION INFRASTRUCTURE
technical data
models, policies, & standards
change recommendations
status
PRODUCE INFORMATION PRODUCT
FINANCIAL MANAGEMENT
new information requirements
DEVELOP INFORMATION STRATEGY
mandates
corporate mission, goals, and information needs
availability feedback
information products
information strategy
approved (user information) requests
Authoritative Agencies
resource requests
Customers
ORGANIZATION MANAGEMENT
information management plans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DEVELOP INFORMATION ARCHITECTURE
DEVELOP INFORMATION GUIDANCE
ORGANIZATION MANAGEMENT
IDENTIFY INFORMATION REQUIREMENTS
DEVELOP INFORMATION POLICIES & STANDARDS
INFORMATION MODEL
INFORMATION SYSTEM
STRATEGIC PLAN
TECHNICAL INFORMATION
INFORMATION MANAGEMENT PLAN
Customers
Authoritative Agencies
new information requirements
unstructured requirements
structured requirements
models, policies, & standards
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resource analyses
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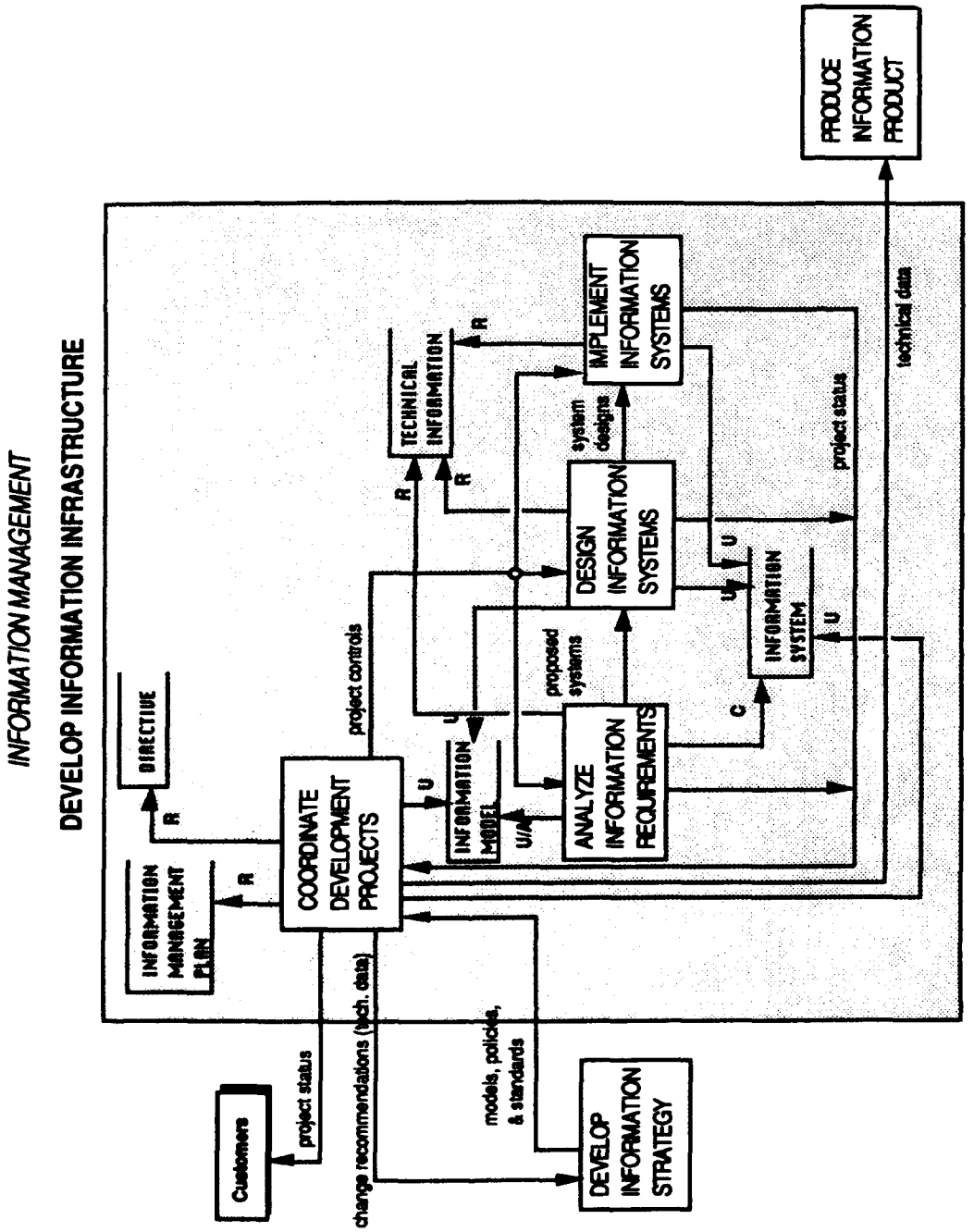
corporate mission, goals, and information needs
mandates
information management plans
resource requests
03/11/91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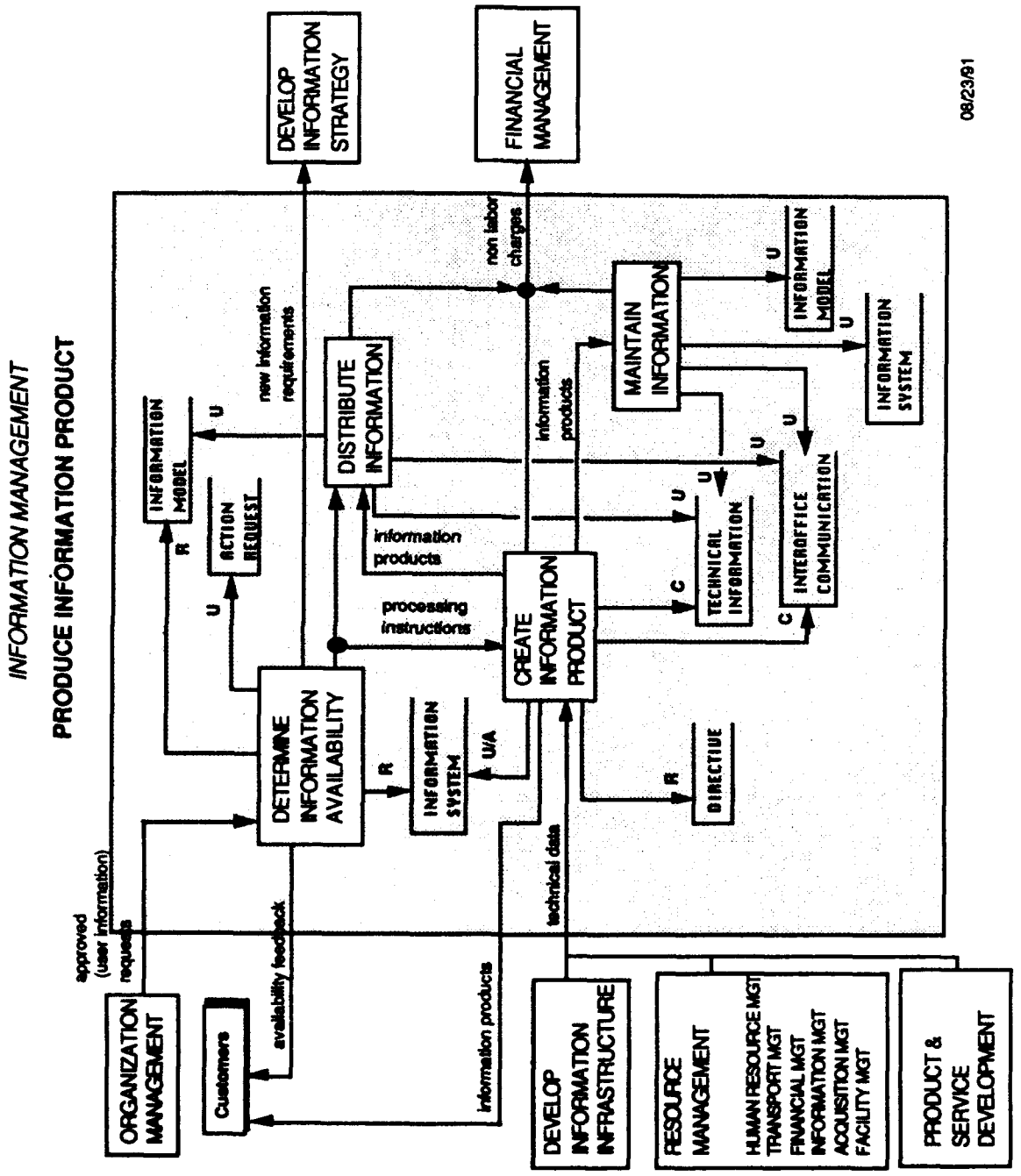
PRODUCE INFORMATION PRODUCT
DIRECTIVE
INFORMATION MANAGEMENT PLAN
COORDINATE DEVELOPMENT PROJECTS
TECHNICAL INFORMATION
IMPLEMENT INFORMATION SYSTEMS
DESIGN INFORMATION SYSTEMS
INFORMATION MODEL
ANALYZE INFORMATION REQUIREMENTS
INFORMATION SYSTEM
Customers
DEVELOP INFORMATION STRATEGY
project controls
system designs
proposed systems
project status
technical data
project status
change recommendations (tech. data)
models, policies, & standards
R
U
U/A
C

03/11/91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FINANCIAL MANAGEMENT
ORGANIZATION MANAGEMENT
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DISTRIBUTE INFORMATION
MAINTAIN INFORMATION
CREATE INFORMATION PRODUCT
INFORMATION MODEL
ACTION REQUEST
INFORMATION SYSTEM
TECHNICAL INFORMATION
INTEROFFICE COMMUNICATION
DIRECTIVE
DEVELOP INFORMATION INFRASTRUCTURE
RESOURCE MANAGEMENT
HUMAN RESOURCE MGT
TRANSPORT MGT
FINANCIAL MGT
INFORMATION MGT
ACQUISITION MGT
FACILITY MGT
PRODUCT & SERVICE DEVELOPMENT
approved (user information) requests
availability feedback
information products
technical data
new information requirements
non labor charges
information products
information products
processing instructions
U
R
U/A
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APPENDIX B

ENTITY-RELATIONSHIP DIAGRAMMING AND ISP DATA MODEL

The Entity Relationship Diagram (ERD) presented in this appendix represents the ISP data model. Some supplementary information that addresses the syntax and semantics of entity relationship diagramming is provided here to assist you in understanding the ERD.

Definition of Entity Type

Entities are simply the things that an enterprise needs to keep information about. Entities can be persons, places, things, concepts, events, etc. that have some meaning and importance for the enterprise. Entities can be categorized into entity types and thought of as particular occurrences of an entity type. For example, if ORGANIZATION was modeled as an entity type, then the entity ENGINEERING AND INFORMATION SYSTEMS DEPARTMENT might be a single occurrence of that entity type.

Entity types are named using singular nouns and represented as rectangular boxes in ERDs.

Definition of Relationship

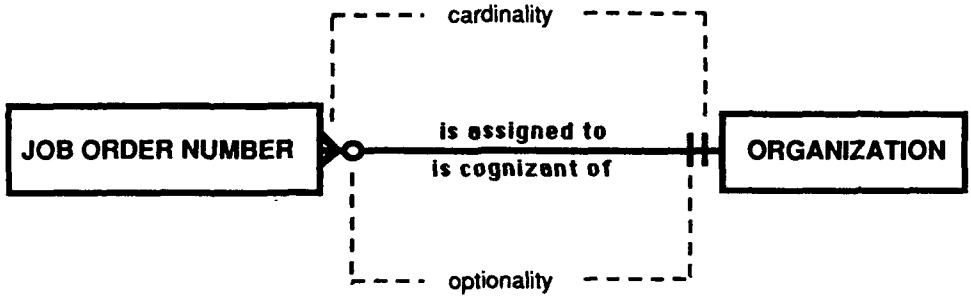
Relationships can be thought of as connections between entity types that represent some business action that occurs in the real world and involves information contained in the pair of connected entity types. All relationships have three properties:

name - describes the business action being represented
cardinality - how many entities may be involved in the action
optionality - whether the action is optional or mandatory

Syntax and Semantics of Entity Relationship Diagrams

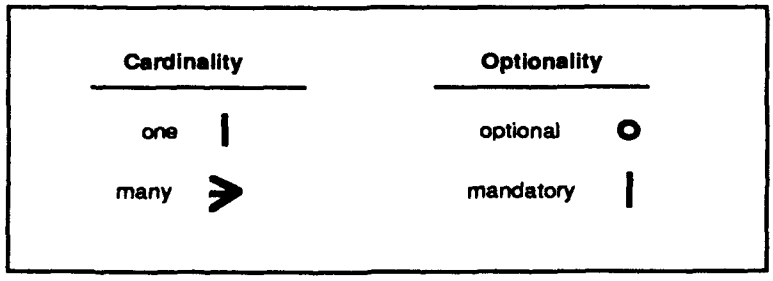
Relationships are represented as lines between entity types. The relationship name and special symbols that represent the cardinality and optionality properties of the relationship appear on the line. Relationships are read by beginning with one of the entity type names and traversing clockwise along the relationship line toward the connected entity type. In the example below, we would read that JOB ORDER NUMBER is assigned to ORGANIZATION and ORGANIZATION is cognizant of JOB ORDER NUMBER.

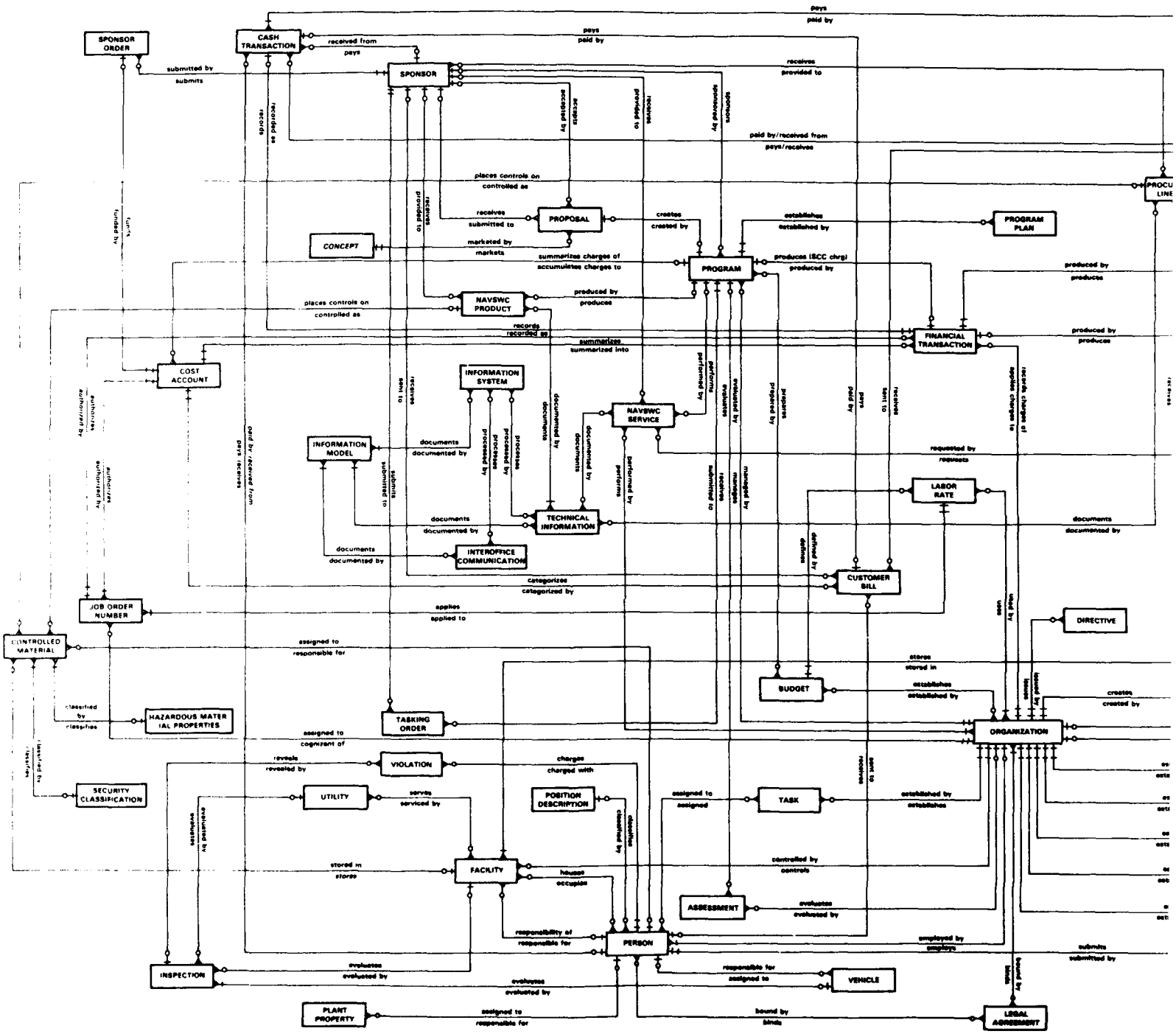
As the following example shows, the symbols nearest the entity type boxes represent the cardinality property and the symbols furthest from the boxes represent the optionality property.



The straight line cardinality symbol means that only one occurrence of that entity type can be involved in the relationship. Reading from our example, "a JOB ORDER NUMBER is assigned to only *one* ORGANIZATION". The crow's foot cardinality symbol means that many occurrences of that entity type can be involved in the relationship. For example, "an ORGANIZATION may be cognizant of *many* JOB ORDER NUMBERs".

The straight line optionality symbol means that the relationship is mandatory; e.g. "a JOB ORDER NUMBER *must* be assigned to an ORGANIZATION". The circle optionality symbol means that the relationship is optional; e.g. "an ORGANIZATION *may* be cognizant of JOB ORDER NUMBERs". The meaning of these symbols is summarized in the following diagram.

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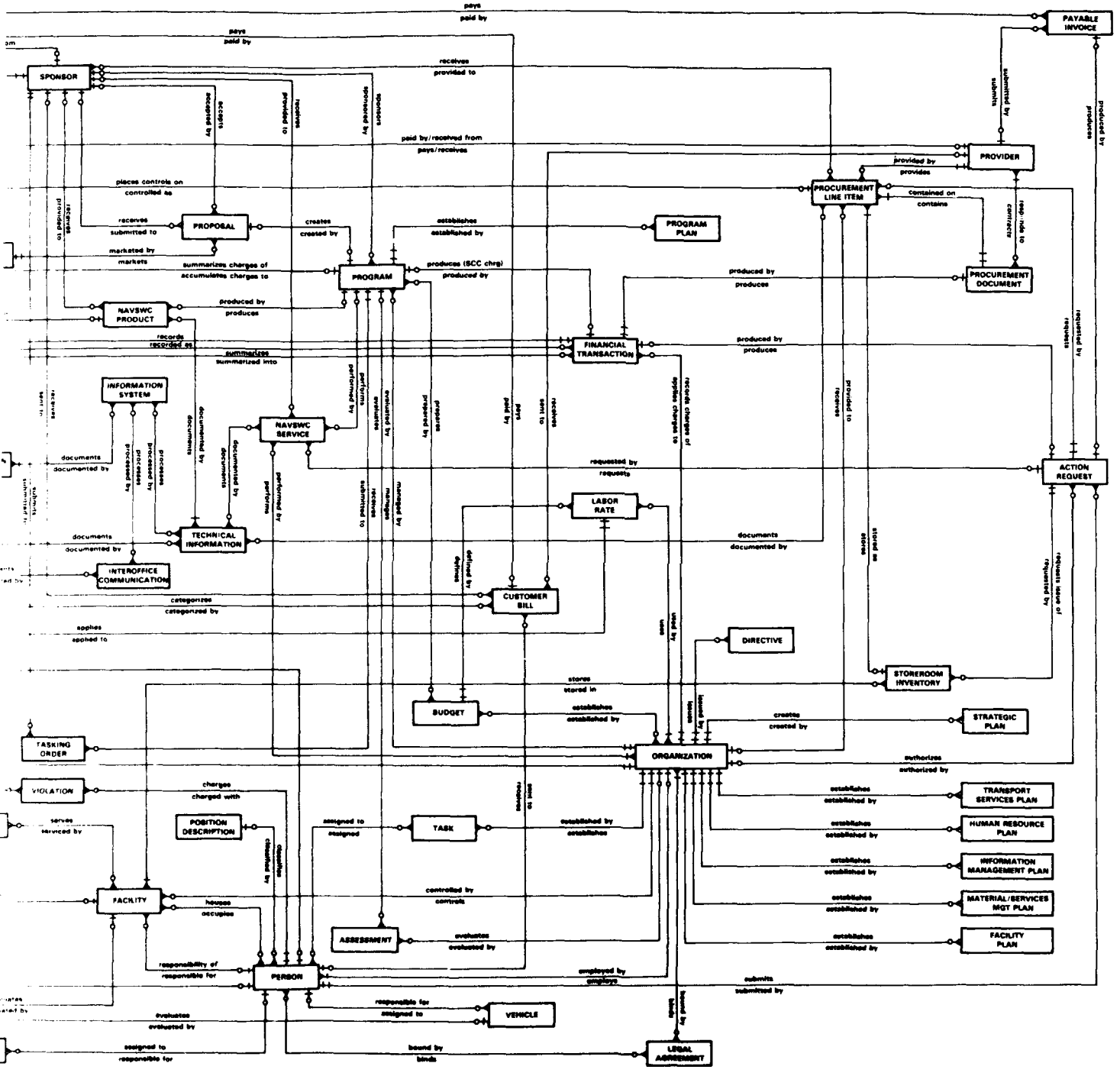
CASH TRANSACTION
SPONSOR
PROPOSAL
CONCEPT
PROGRAM
PROGRAM PLAN
NAVSWC PRODUCT
FINANCIAL TRANSACTION
COST ACCOUNT
INFORMATION SYSTEM
NAVSWC SERVICE
INFORMATION MODEL
TECHNICAL INFORMATION
INTEROFFICE COMMUNICATION
LABOR RATE
CUSTOMER BILL
JOB ORDER NUMBER
CONTROLLED MATERIAL
DIRECTIVE
BUDGET
HAZARDOUS MATERIAL PROPERTIES
TASKING ORDER
ORGANIZATION
SECURITY CLASSIFICATION
VIOLATION
UTILITY
POSITION DESCRIPTION
TASK
FACILITY
ASSESSMENT
INSPECTION
PERSON
VEHICLE
PLANT PROPERTY
LEGAL AGREEMENT
submitted by
submits
receives
provided to
pays
paid by
receives from
pays/receives
places controls on
controlled as
receives submitted to
creates
created by
established by
markets
marketed by
summarizes charges of
accumulates charges to
produces (SCC chrg)
produced by
records
recorded as
summarizes
summarized into
documents
documented by
processes
processed by
performs
performed by
prepares
prepared by
requests
requested by
manages
managed by
applies
applied to
assigned to
responsible for
stores
stored in
classifies
classified by
reveals
revealed by
charges
charged with
serves
serviced by
assigned to
cognizant of
controls
controlled by
houses
occupies
evaluates
evaluated by
employs
employed by
bound by
binds


SPONSOR
PROPOSAL
PROGRAM
PROGRAM PLAN
NAVSWC PRODUCT
FINANCIAL TRANSACTION
INFORMATION SYSTEM
NAVSWC SERVICE
TECHNICAL INFORMATION
INTEROFFICE COMMUNICATION
LABOR RATE
CUSTOMER BILL
BUDGET
DIRECTIVE
STOREROOM INVENTORY
STRATEGIC PLAN
TASKING ORDER
ORGANIZATION
VIOLATION
POSITION DESCRIPTION
TASK
TRANSPORT SERVICES PLAN
HUMAN RESOURCE PLAN
INFORMATION MANAGEMENT PLAN
MATERIAL/SERVICES MGT PLAN
FACILITY PLAN
FACILITY
ASSESSMENT
PERSON
VEHICLE
LEGAL AGREEMENT
PAYABLE INVOICE
PROVIDER
PROCUREMENT LINE ITEM
PROCUREMENT DOCUMENT
ACTION REQUEST

APPENDIX C

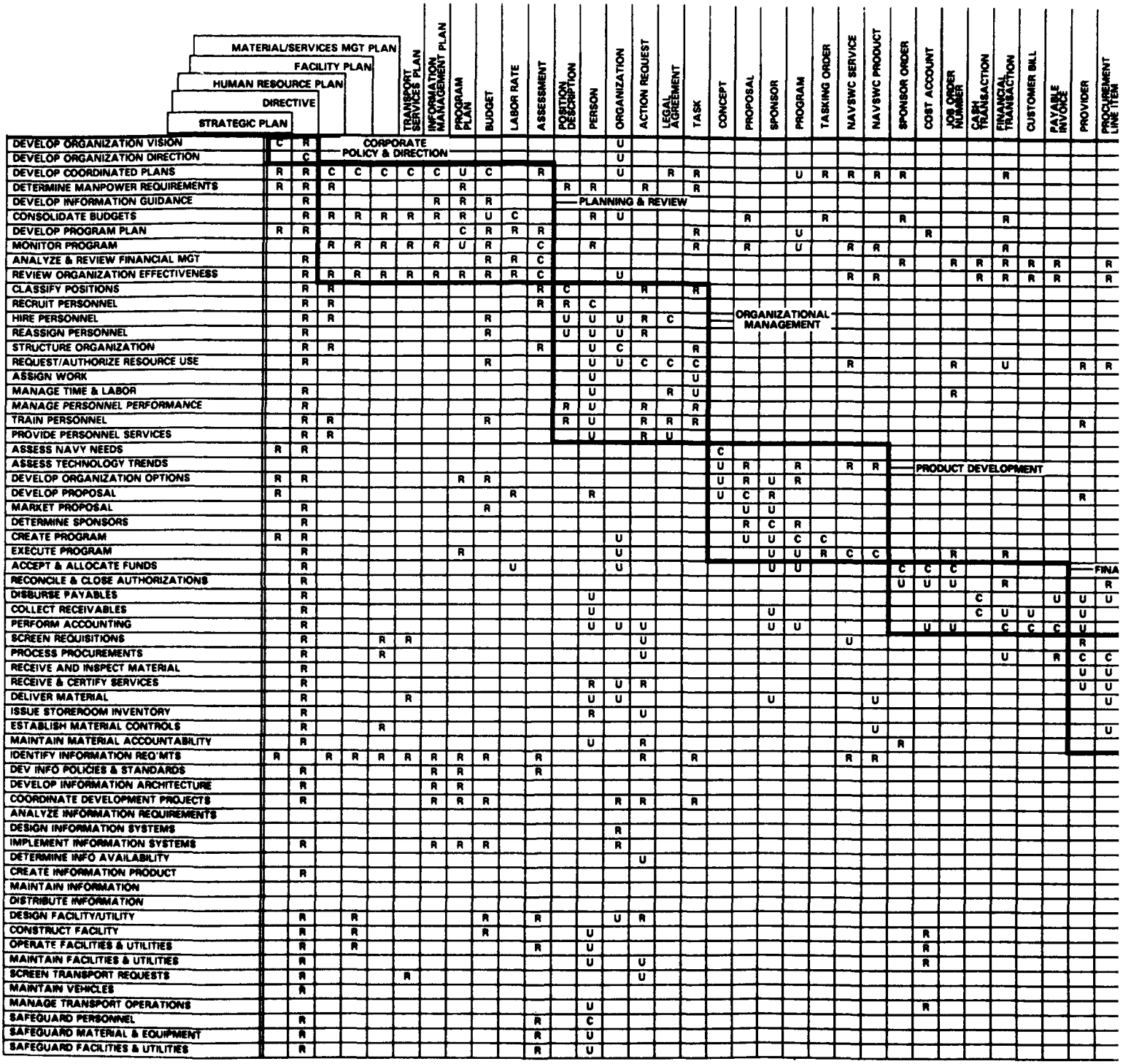
CLUSTERED CRUD MATRIX

The CRUD Matrix shows the interactions of processes to entity types. The matrix lists the lowest level functions (processes) in rows, the entity types in columns, and records either a C, R, U, or D in the appropriate cell to indicate the kind of interactions that can take place. By convention, only a single interaction code is entered into a cell, so a hierarchy of interactions is used.

C in a cell means the process may create, delete, update, and read that entity type
D means the process may delete, update, and read the entity type
U means the process may update and read the entity type
R means the process may only read the entity type

Business areas are indicated in this matrix as the bold line boxes. These groupings of entity types and processes define the boundaries of the BAA projects to be undertaken in the next phase of the methodology.

The first thing that we should observe about the matrix is that it is not a very sparse matrix; i.e., many of the cells contain entries. The number of entries falling outside of a box for the processes and entity types within the box show where when we move to the next phases we will have problems. If you look across the top of the matrix and find the column labelled PERSON and then scan down its column, you will see that this entity type information is used by many processes and Business Areas. The analysis of what information it would contain will be performed during the analysis of the Organizational Management Business Area. Unfortunately, that business area will not be done until after the Financial Management Business Area, which needs to update PERSON. No matter which Business Area we started with, we would have the same problem. Looking down the process column to the process labelled REVIEW ORGANIZATIONAL EFFECTIVENESS and then moving across its row, we see the same problem in this axis; i.e., more than just the Planning & Review Business Area performs this generic process. The inter-relationship problems point to the need for a strong DA and model management configuration effort. We can also expect to have to go back and rework some previous business areas when more information is revealed about both their processes and entity types by later business area analysis performing the same generic processes, but maybe not the same in detail or the "how."


MATERIAL/SERVICES MGT PLAN
FACILITY PLAN
HUMAN RESOURCE PLAN
DIRECTIVE
STRATEGIC PLAN
TRANSPORT SERVICES PLAN
INFORMATION MANAGEMENT PLAN
PROGRAM PLAN
BUDGET
LABOR RATE
ASSESSMENT
POSITION DESCRIPTION
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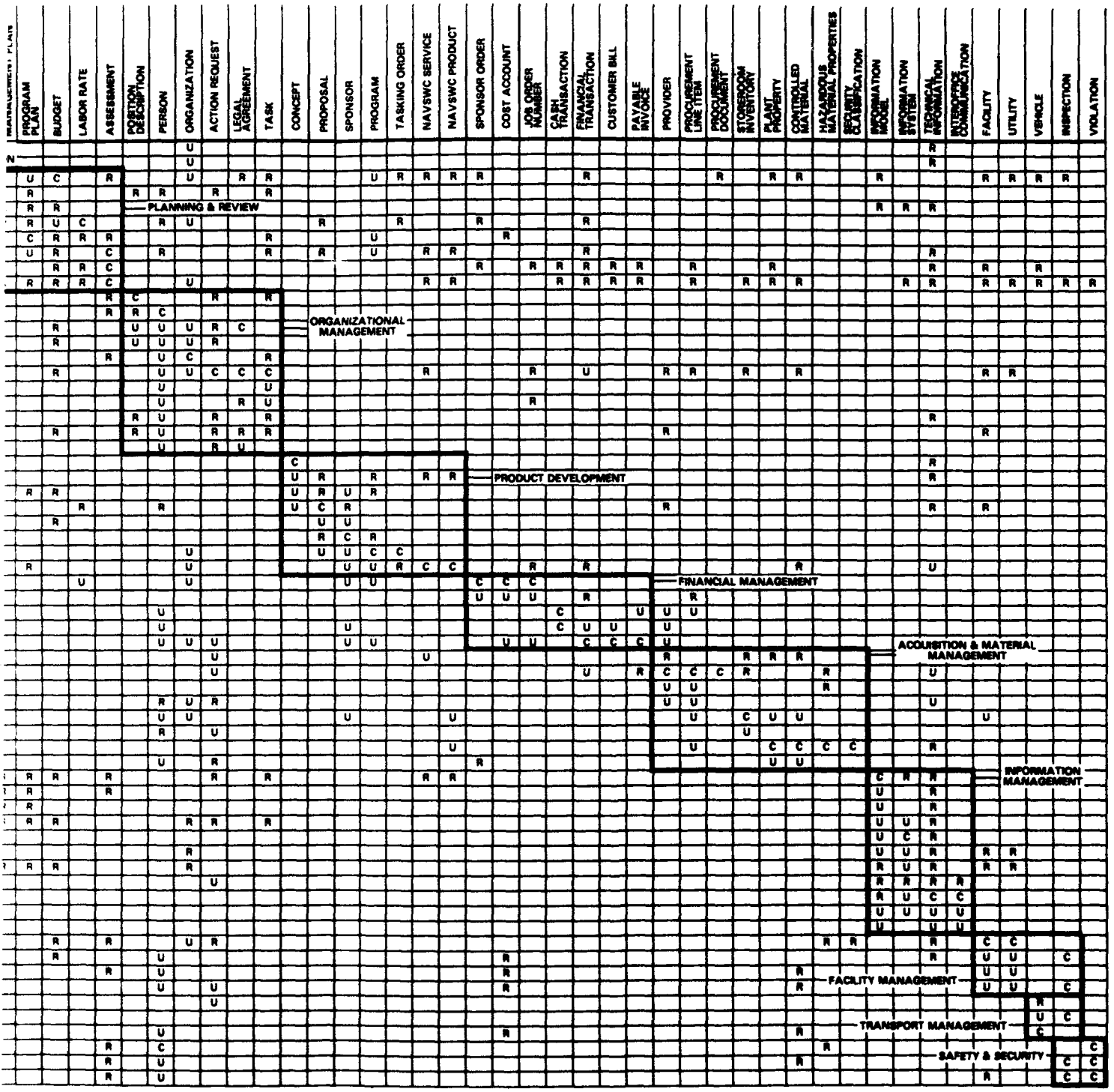
ORGANIZATION
ACTION REQUEST
LEGAL AGREEMENT
TASK
CONCEPT
PROPOSAL
SPONSOR
PROGRAM
TASKING ORDER
NAVSWC SERVICE
NAVSWC PRODUCT
SPONSOR ORDER
COST ACCOUNT
JOB ORDER NUMBER
CASH TRANSACTION
FINANCIAL TRANSACTION
CUSTOMER BILL
PAYABLE INVOICE
PROVIDER
PROCUREMENT LINE ITEM
CORPORATE POLICY & DIRECTION
PLANNING & REVIEW
ORGANIZATIONAL MANAGEMENT
PRODUCT DEVELOPMENT
DEVELOP ORGANIZATION VISION
DEVELOP ORGANIZATION DIRECTION
DEVELOP COORDINATED PLANS
DETERMINE MANPOWER REQUIREMENTS
DEVELOP INFORMATION GUIDANCE
CONSOLIDATE BUDGETS
DEVELOP PROGRAM PLAN
MONITOR PROGRAM
ANALYZE & REVIEW FINANCIAL MGT
REVIEW ORGANIZATION EFFECTIVENESS
CLASSIFY POSITIONS
RECRUIT PERSONNEL
HIRE PERSONNEL
REASSIGN PERSONNEL
STRUCTURE ORGANIZATION
REQUEST/AUTHORIZE RESOURCE USE
ASSIGN WORK
MANAGE TIME & LABOR
MANAGE PERSONNEL PERFORMANCE
TRAIN PERSONNEL
PROVIDE PERSONNEL SERVICES
ASSESS NAVY NEEDS
ASSESS TECHNOLOGY TRENDS
DEVELOP ORGANIZATION OPTIONS
DEVELOP PROPOSAL
MARKET PROPOSAL
DETERMINE SPONSORS
CREATE PROGRAM
EXECUTE PROGRAM
ACCEPT & ALLOCATE FUNDS
RECONCILE & CLOSE AUTHORIZATIONS
DISBURSE PAYABLES
COLLECT RECEIVABLES
PERFORM ACCOUNTING
SCREEN REQUISITIONS
PROCESS PROCUREMENTS
RECEIVE AND INSPECT MATERIAL
RECEIVE & CERTIFY SERVICES
DELIVER MATERIAL
ISSUE STOREROOM INVENTORY
ESTABLISH MATERIAL CONTROLS
MAINTAIN MATERIAL ACCOUNTABILITY
IDENTIFY INFORMATION REQ'MTS
DEV INFO POLICIES & STANDARDS
DEVELOP INFORMATION ARCHITECTURE
COORDINATE DEVELOPMENT PROJECTS
ANALYZE INFORMATION REQUIREMENTS
DESIGN INFORMATION SYSTEMS
IMPLEMENT INFORMATION SYSTEMS
DETERMINE INFO AVAILABILITY
CREATE INFORMATION PRODUCT
MAINTAIN INFORMATION
DISTRIBUTE INFORMATION
DESIGN FACILITY/UTILITY
CONSTRUCT FACILITY
OPERATE FACILITIES & UTILITIES
MAINTAIN FACILITIES & UTILITIES
SCREEN TRANSPORT REQUESTS
MAINTAIN VEHICLES
MANAGE TRANSPORT OPERATIONS
SAFEGUARD PERSONNEL
SAFEGUARD MATERIAL & EQUIPMENT
SAFEGUARD FACILITIES & UTILITIES
FINA


PROGRAM PLAN
BUDGET
LABOR RATE
ASSESSMENT
POSITION DESCRIPTION
PERSON
ORGANIZATION
ACTION REQUEST
LEGAL AGREEMENT
TASK
CONCEPT
PROPOSAL
SPONSOR
PROGRAM
TASKING ORDER
NAVSWC SERVICE
NAVSWC PRODUCT
SPONSOR ORDER
COST ACCOUNT
JOB ORDER NUMBER
CASH TRANSACTION
FINANCIAL TRANSACTION
CUSTOMER BILL
PAYABLE INVOICE
PROVIDER
PROCUREMENT LINE ITEM
PROCUREMENT DOCUMENT
STOREROOM INVENTORY
PLANT PROPERTY
CONTROLLED MATERIAL
HAZARDOUS MATERIAL PROPERTIES
SECURITY CLASSIFICATION
INFORMATION MODEL
INFORMATION SYSTEM
TECHNICAL INFORMATION
INTERPROCESS COMMUNICATION
FACILITY
UTILITY
VEHICLE
INSPECTION
VIOLATION
PLANNING & REVIEW
ORGANIZATIONAL MANAGEMENT
PRODUCT DEVELOPMENT
FINANCIAL MANAGEMENT
ACQUISITION & MATERIAL MANAGEMENT
INFORMATION MANAGEMENT
FACILITY MANAGEMENT
TRANSPORT MANAGEMENT
SAFETY & SECURITY

APPENDIX D

DATA FLOW DIAGRAMS

The Data Flow Diagrams (DFDs) presented in this appendix represent the ISP Business Systems Models. Some supplementary information which addresses the syntax and semantics of data flow diagraming is provided here to assist you in understanding the data flow diagrams.

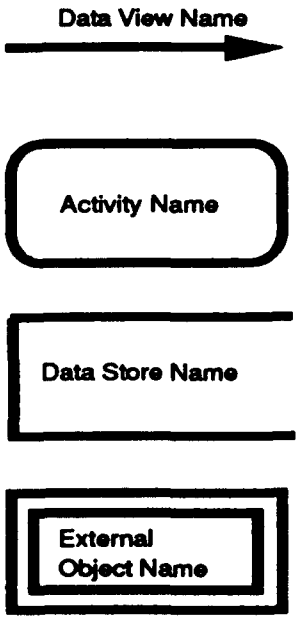
What is a Data Flow Diagram?

Different business activities at NSWCDD do not operate independently of each other. There is a lot of interaction. For example, the activity involved with processing an acquisition request; i.e., stub, will interact with financial activities to provide data on costs, will interact with program or line management activities to exchange information on schedules for delivery, will interact with personnel management or security/safety management activities to exchange accountability information. The ISP work defined Business Areas and Business Systems within Business Areas at a high level. The Business Systems are composed of processes defined by the functional decomposition of NSWCDD business. The ISP also defined data stores comprised of one or more entity types.

A DFD shows the data flow into, out of, and between the business systems and subsystems; i.e., activities, defined by the ISP. They show how activities and data stores interact by showing the flow of actual data between designated activities and data stores.

Conventions in Reading DFDs

The DFDs use particular shapes to represent certain items of interest:



data flow with type of data exchanged

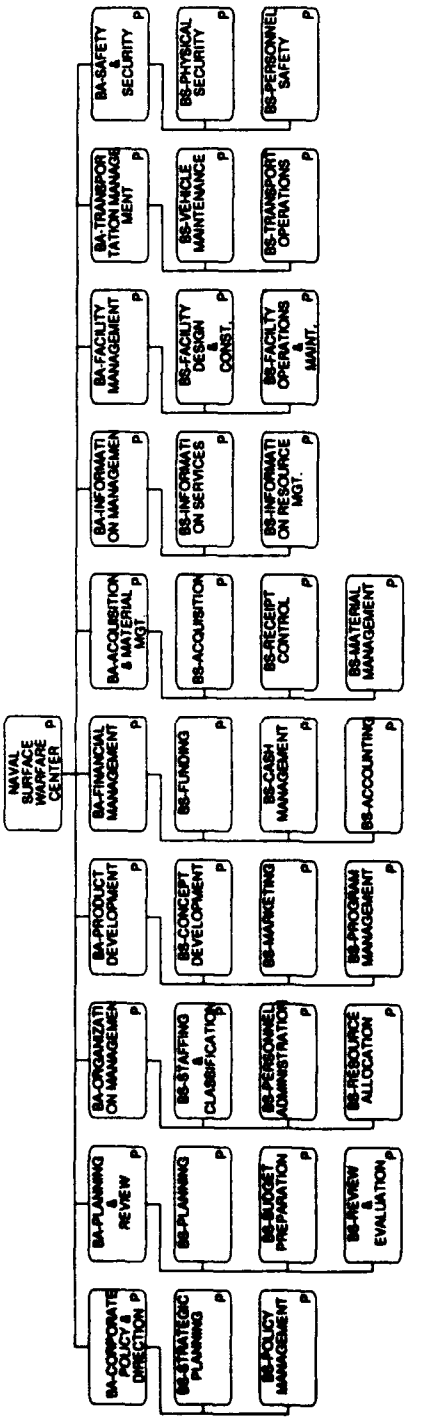
activity; e.g., system, sub-system

data store

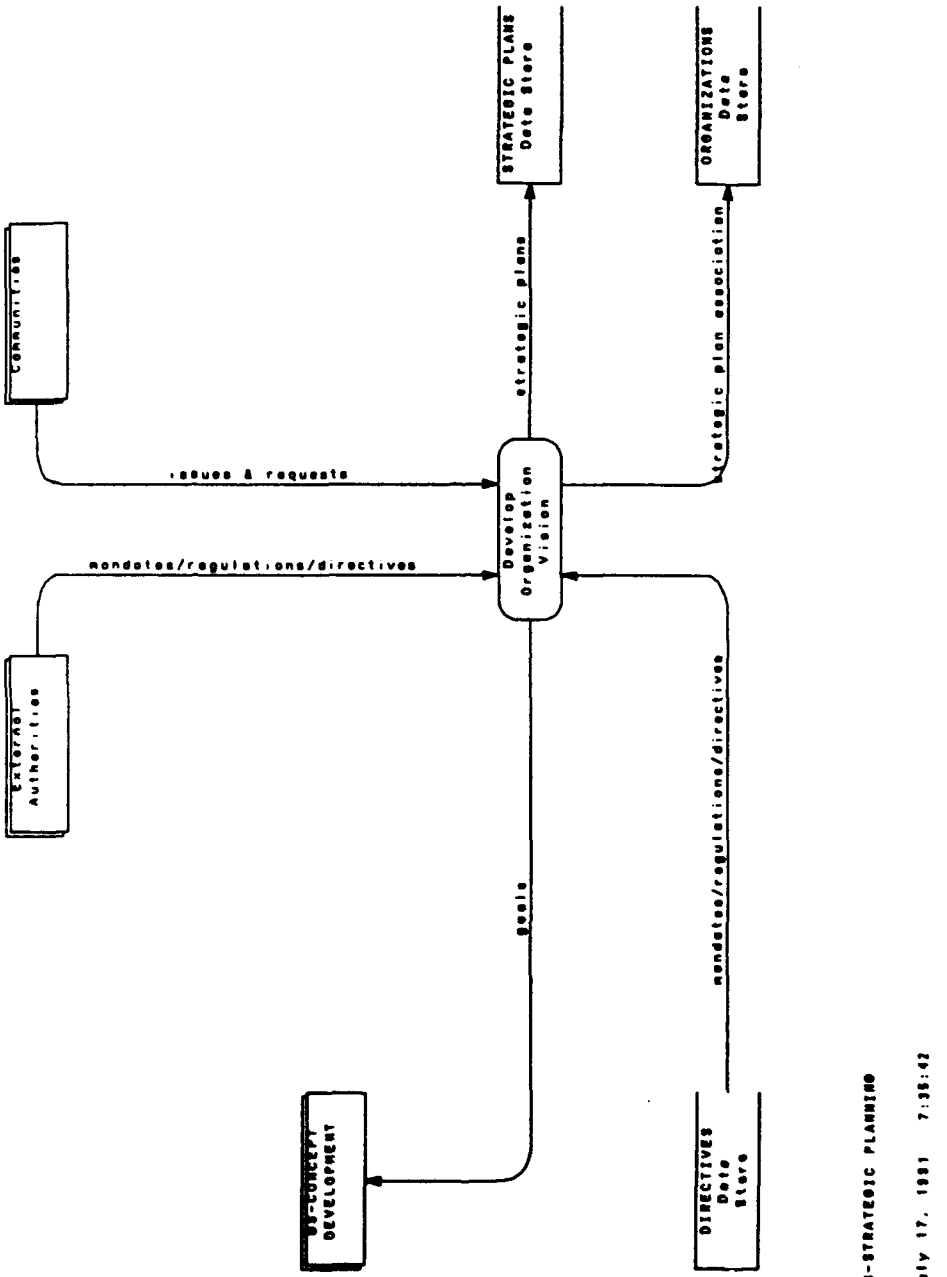
external object; e.g., system or sub-system outside of this decomposition

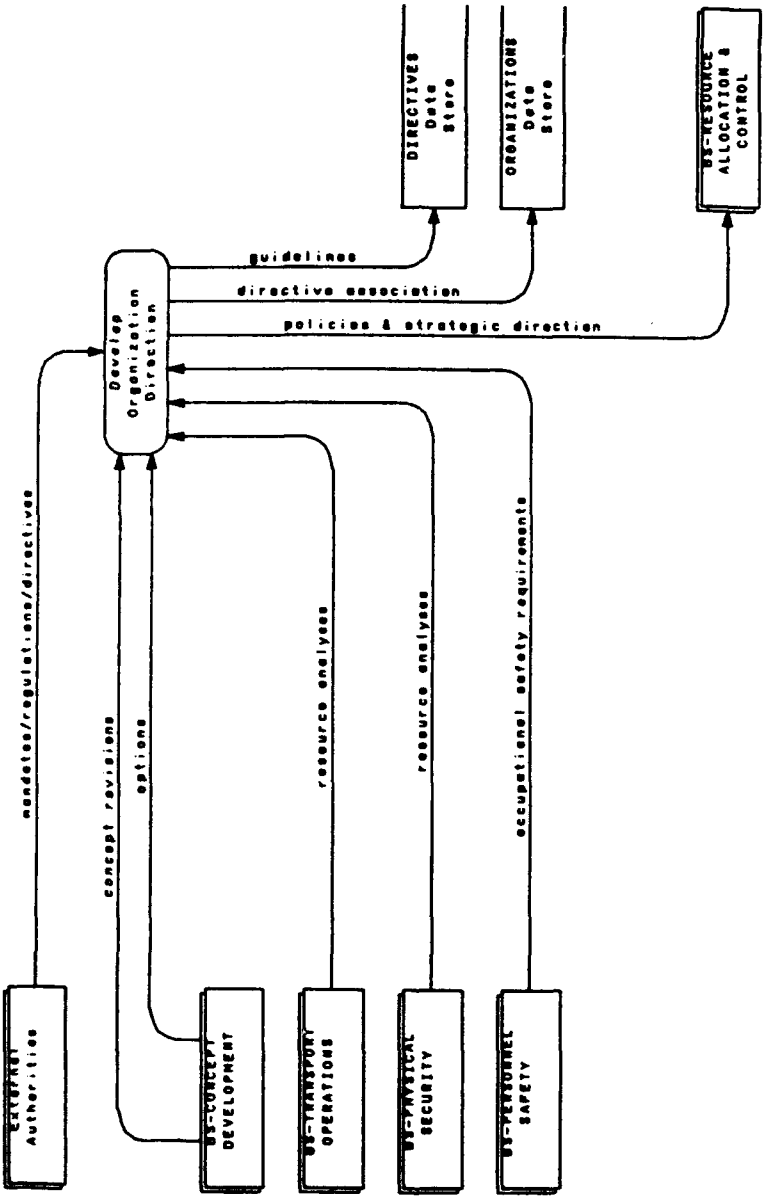
The DFDs are arranged in order of the decomposition. The first page will show the top level decomposition for NSWCDD. Then, each Business System in turn is shown. For each Business System, the first page will be the top level decomposition for the Business System into sub-systems. Each subsystem then follows in order for that Business System. In the subsystem diagram you will see the processes making up the subsystem and any interactions between them and the data stores. You will also see any interactions between the subsystem and other Business Systems, which will be represented as an External Object.

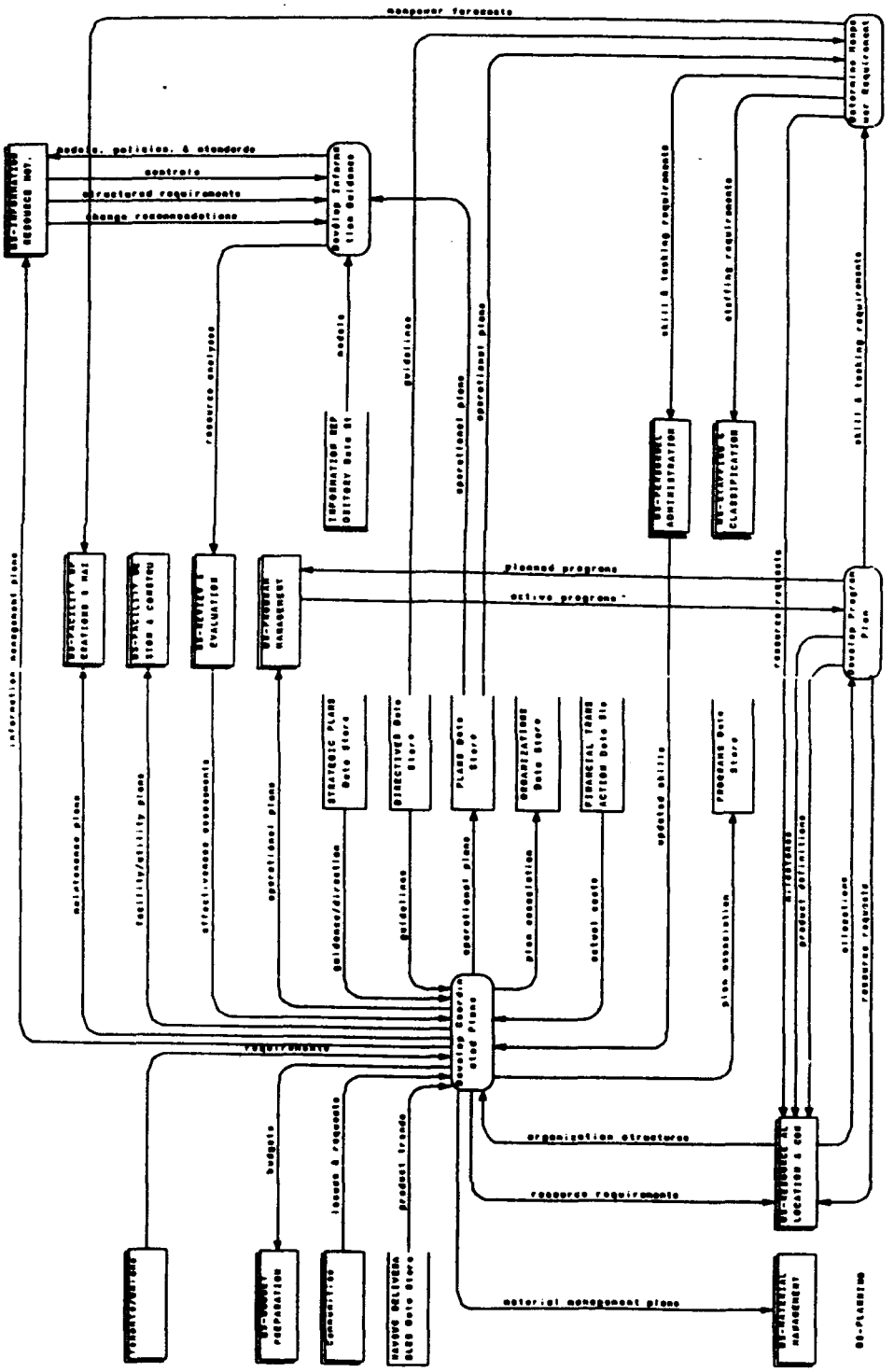
The DFDs were generated from the CASE tool. In printing DFDs, the tool does word wrapping; i.e., splits a word based on number of characters printed out instead of hyphenation rules. The word wraps are not a mistake in the models but only a printing anomaly.

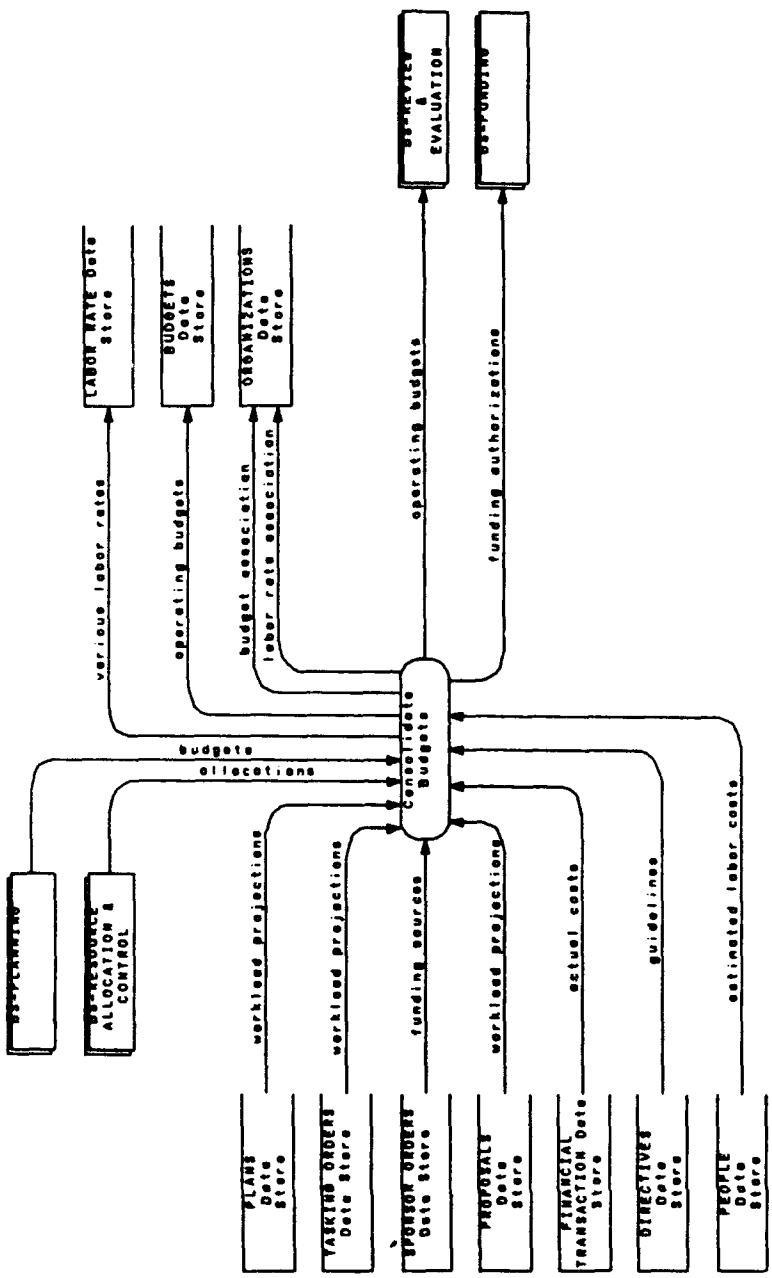


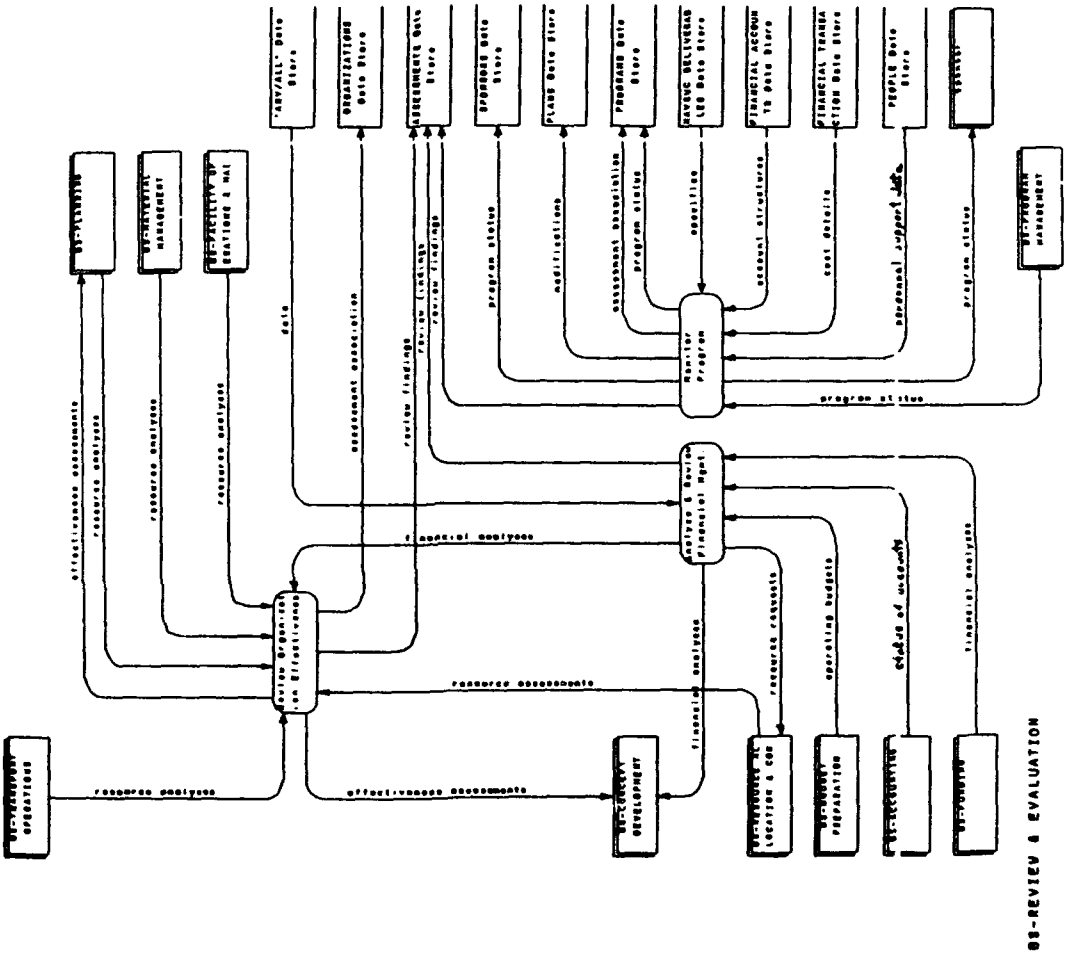
Decomposition Diagrammer - NAVAL SURFACE WARFARE CENTER - July 17, 1991

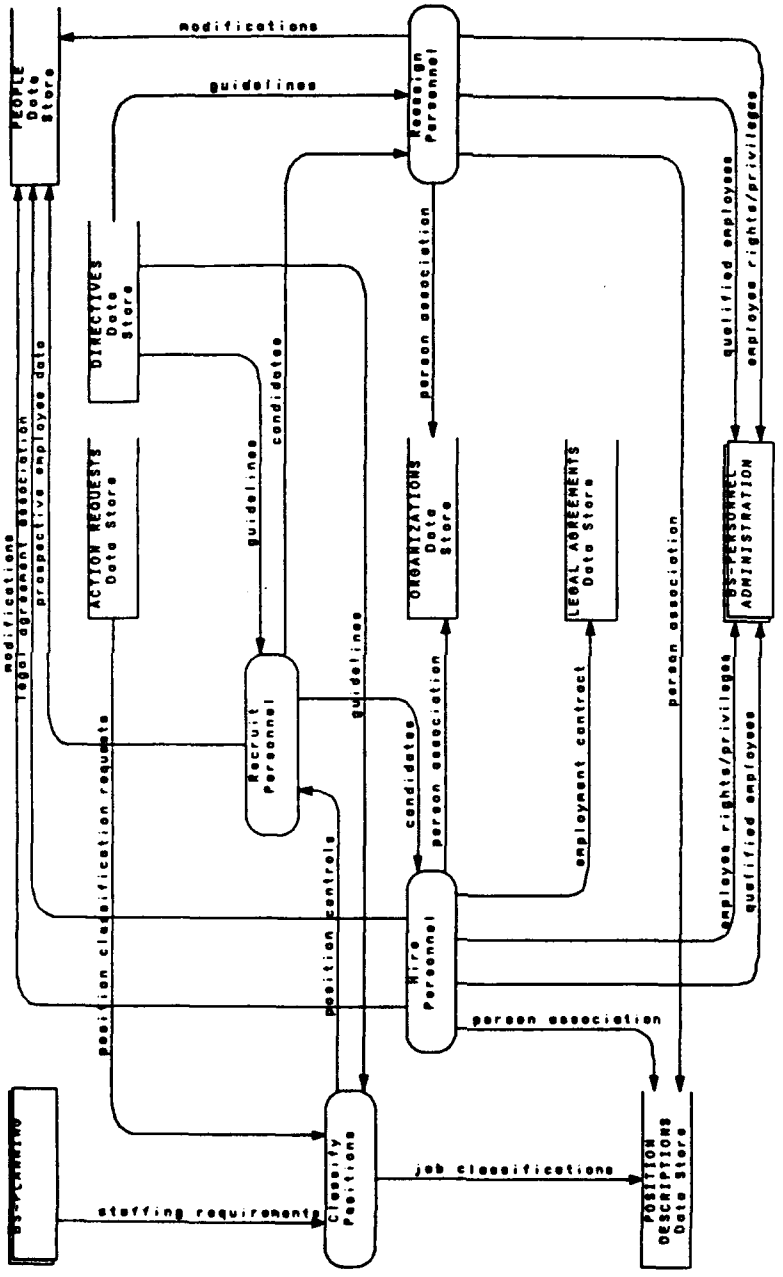

STRATEGIC PLANS
Data Store
ORGANIZATIONS
Data
Store
Consumities
strategic plans
issues & requests
Develop
Organization
Vision
mandates/regulations/directives
Enterprise
Authorities
goals
mandates/regulations/directives
DIRECTIVES
Data
Store
BS-STRATEGIC PLANNING
July 17, 1991 7:35:42


DIRECTIVES Data Store
ORGANIZATIONS Data Store
BS-RESOURCE ALLOCATION & CONTROL
guidelines
directive association
policies & strategic direction
Develop Organization Direction
mandates/regulations/directives
concept revisions
options
resource analyses
resource analyses
occupational safety requirements
External Authorities
BS-CONCEPT DEVELOPMENT
BS-TRANSPORT OPERATIONS
BS-PHYSICAL SECURITY
BS-PERSONNEL SAFETY
BS-POLICY MANAGEMENT
July 17, 1991 7:38:00



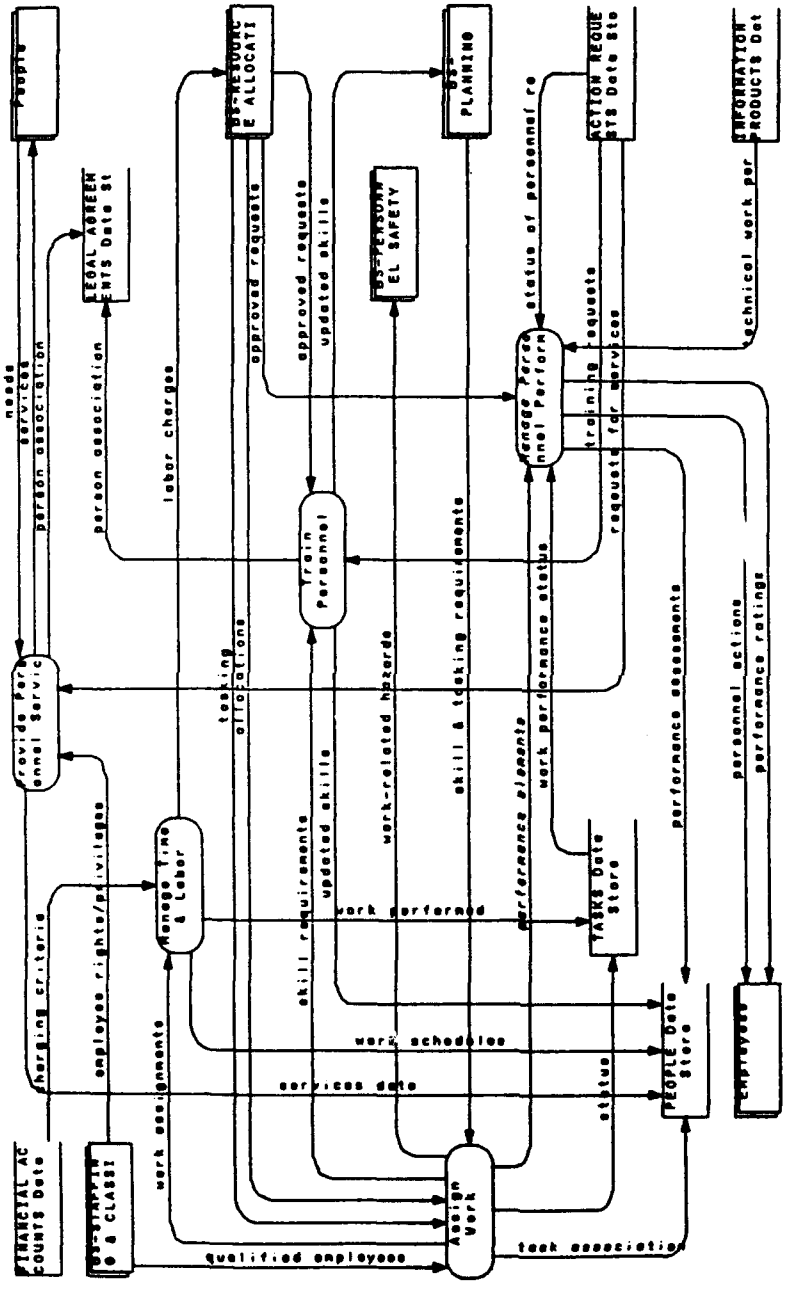

LABOR RATE Data Store
BUDGETS Data Store
ORGANIZATIONS Data Store
various labor rates
operating budgets
budget association
labor rate association
operating budgets
funding authorizations
budgets
allocations
Consolidate Budgets
workload projections
workload projections
funding sources
workload projections
actual costs
guidelines
estimated labor costs
PLANS Data Store
TASKING ORDERS Data Store
SPONSOR ORDERS Data Store
PROPOSALS Data Store
FINANCIAL TRANSACTION Data Store
OBJECTIVES Data Store
PEOPLE Data Store
BS-BUDGET PREPARATION
July 17, 1991 7:37:11

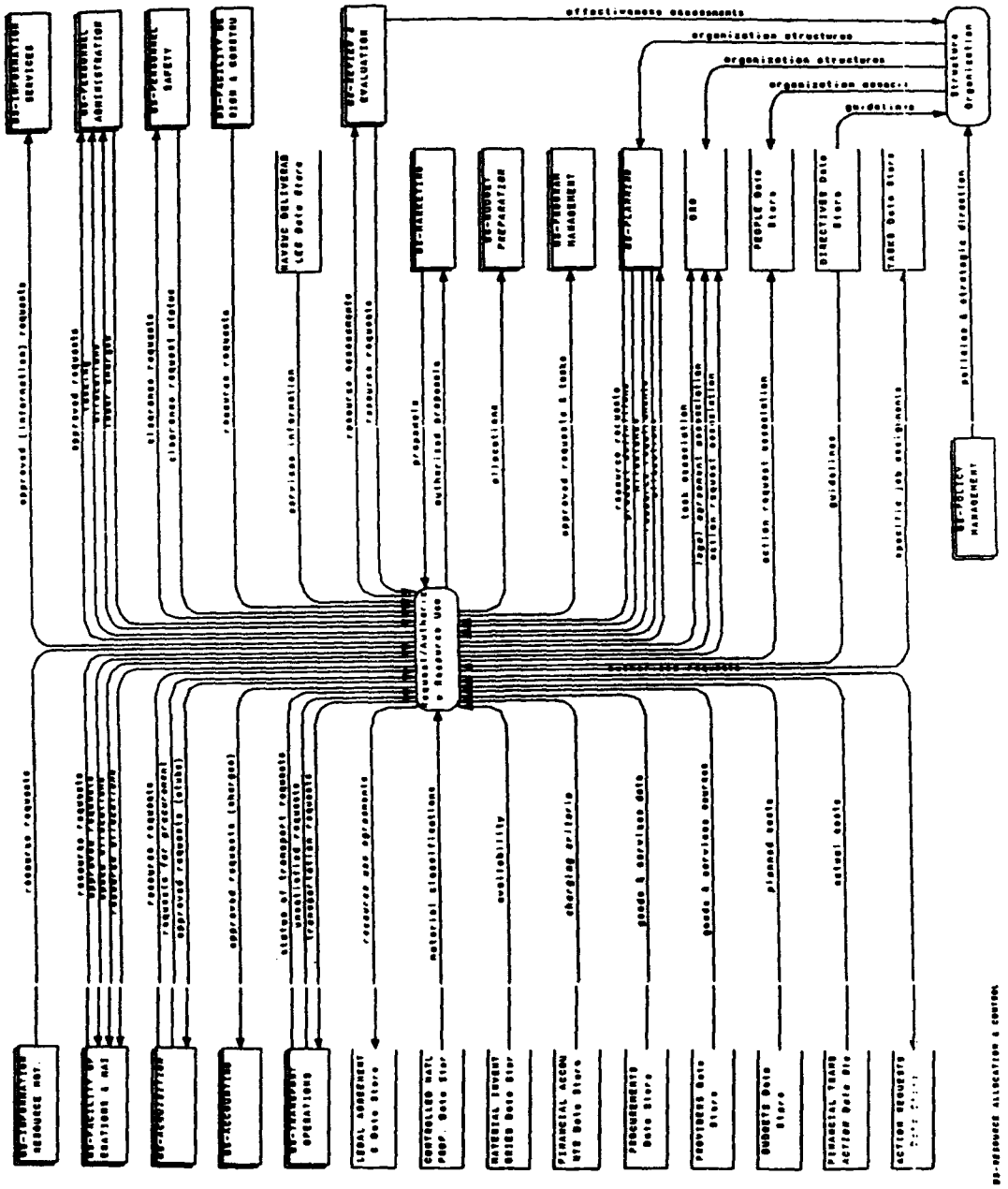

"DEV/ALL" Data Store
ORGANIZATIONS Data Store
REQUIREMENTS Data Store
SCHEDULE Data Store
PLANS Data Store
PROGRAMS Data Store
REVENUE DELIVERED LOE Data Store
FINANCIAL ACCOUNTS Data Store
FINANCIAL TRANSACTION Data Store
PEOPLE Data Store
RESOURCES
Monitor Program
Analyze & Review Financial Mgmt
Review Organization & Directorate
program status
modifications
assessment completion
acquisition
account structures
cost details
personnel support data
program status
program status
data
assessment association
review findings
review findings
resource analyses
resource analyses
resource analyses
effectiveness assessments
financial analyses
resource assessments
financial analyses
resources requests
operating budgets
status of accounts
financial analyses
resource analyses
effectiveness assessments
DEVELOPMENT
LOCATION & CODE
PREPARATION
RESOURCES
OPERATIONS
RESOURCES
DEVELOPMENT

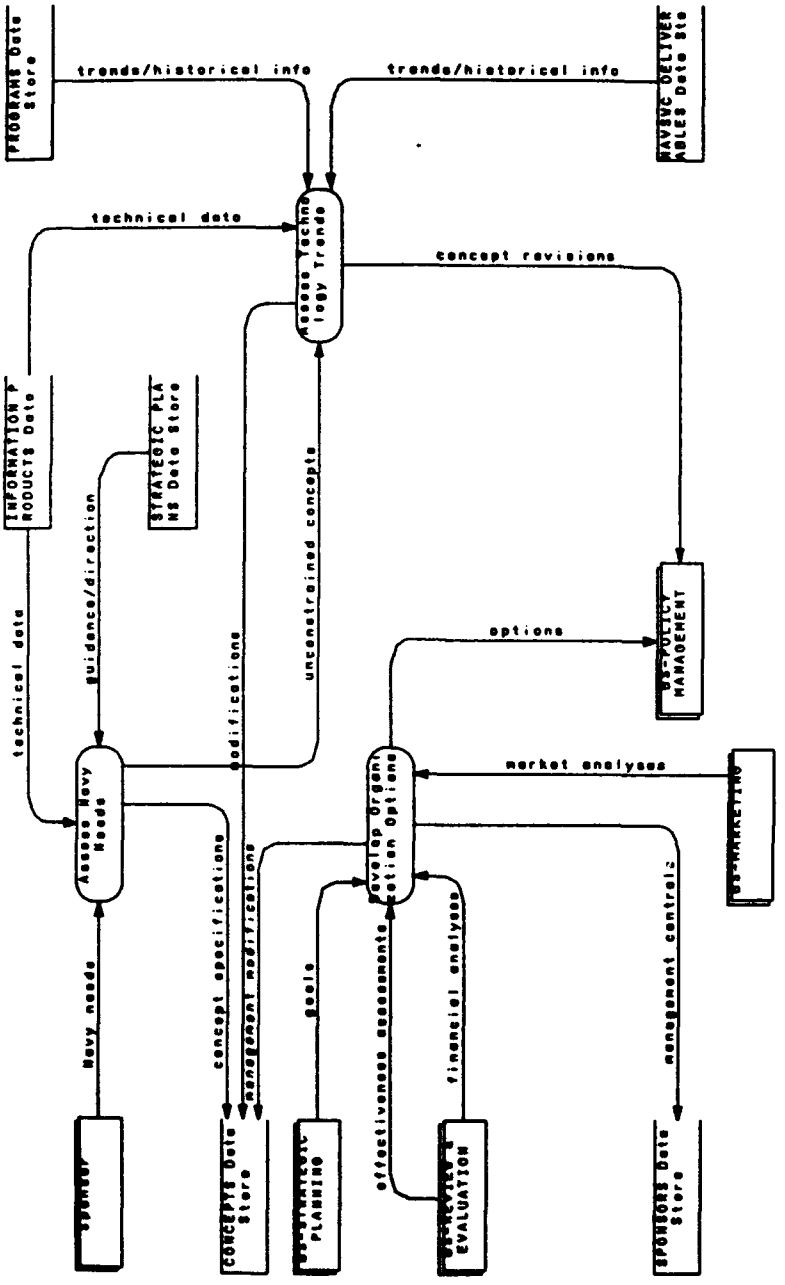


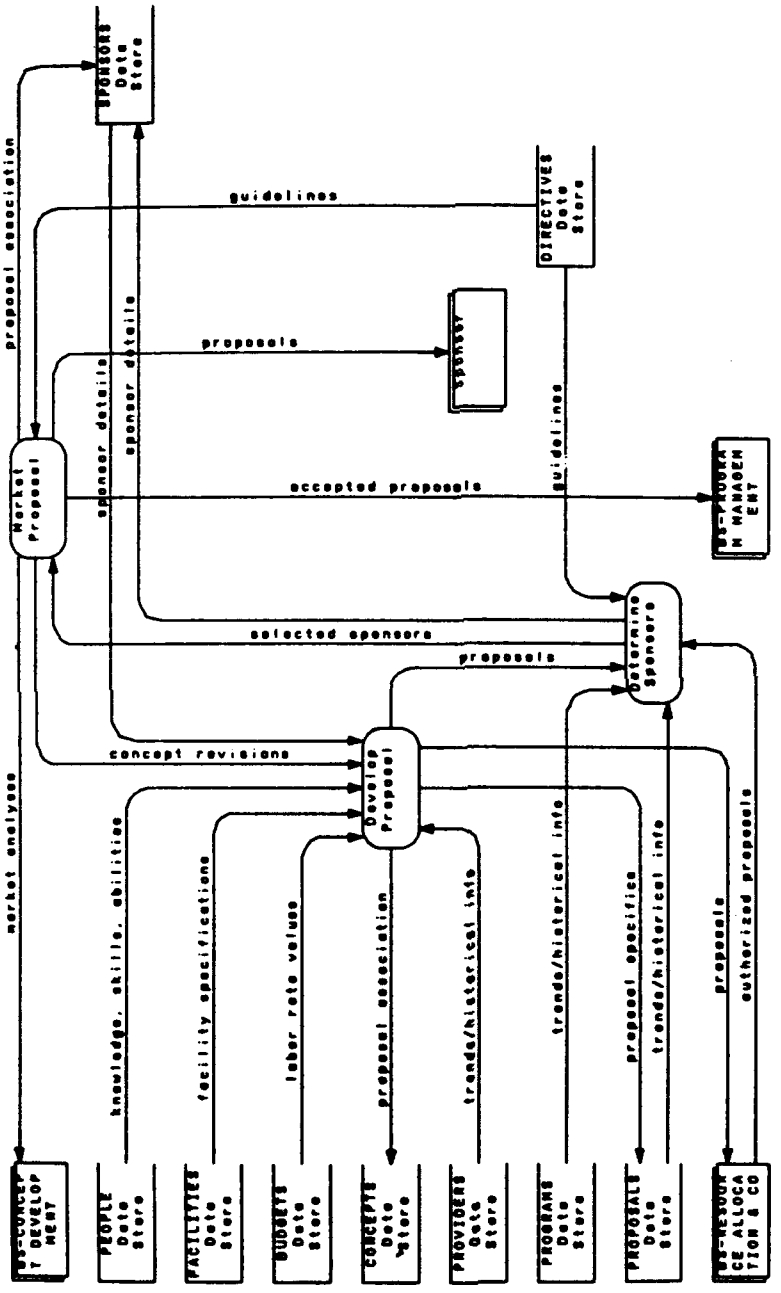
DS-STAFFING & CLASSIFICATION

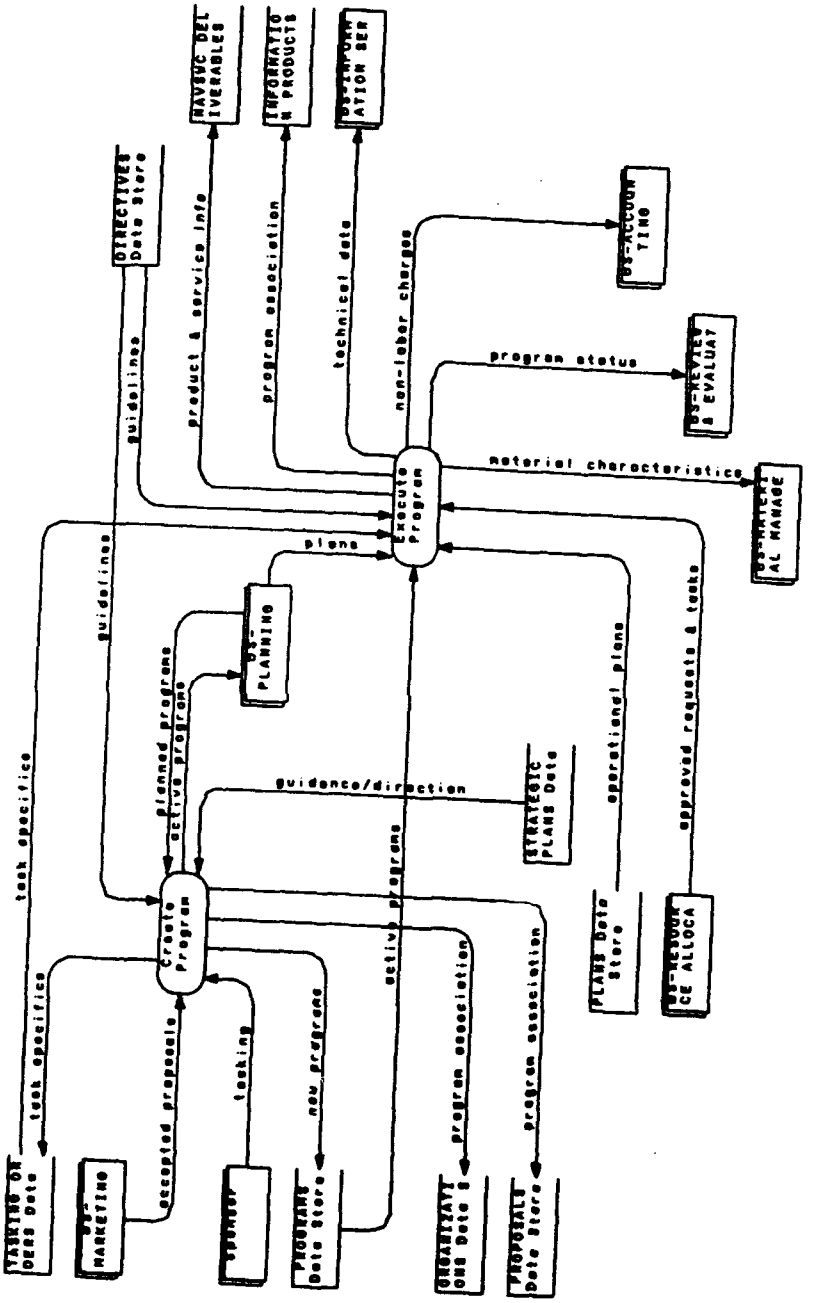
July 17, 1991 7:38:14

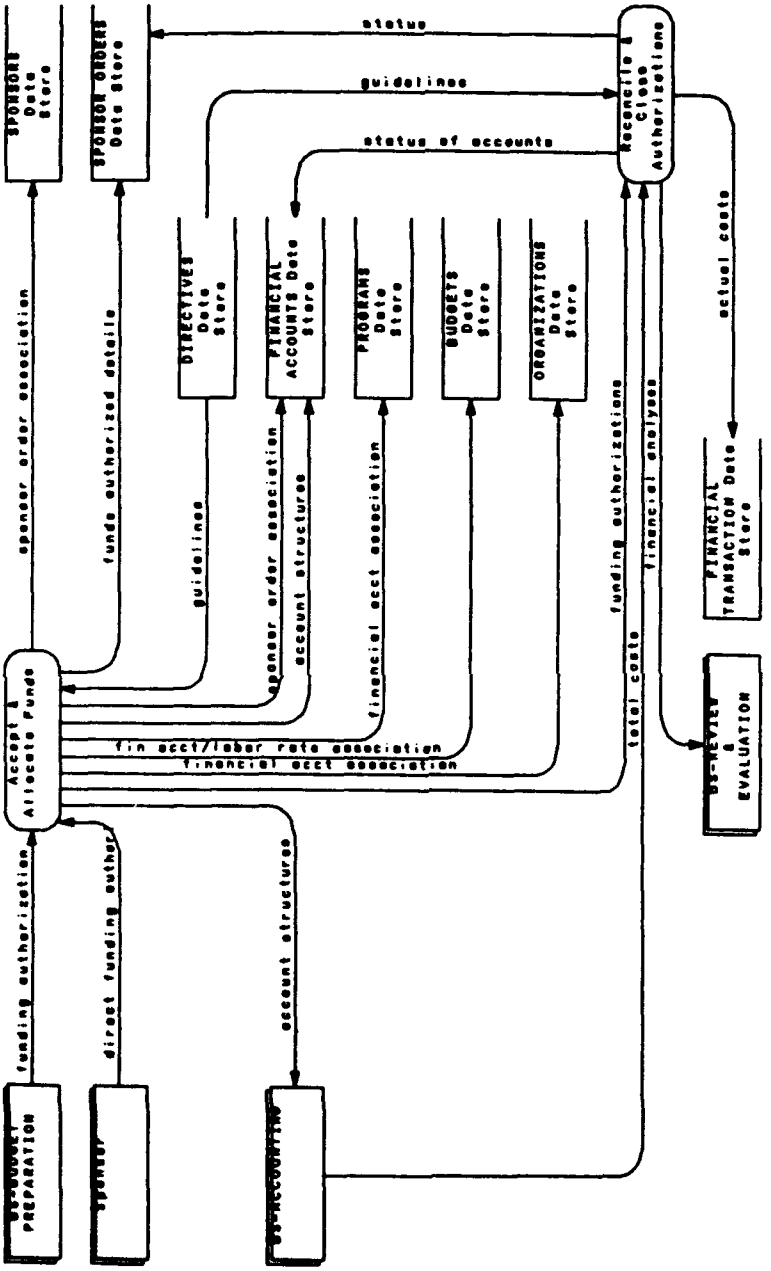

People
LEGAL AGREEMENTS Data St
PERSONNEL ALLOCATI
PERSONNEL PLANNING
ACTION REQUESTS Data Sto
INFORMATION PRODUCTS Dat
needs
services
person association
labor charges
approved requests
updated skills
status of personnel re
training requests
technical work per
Provide Personnel Servic
Train Personnel
Manage Personnel Perform
tasking
allocations
hiring criteria
employee rights/privileges
Manage Time & Labor
skill requirements
updated skills
work-related hazards
skill & tasking requirements
work performed
performance elements
work performance status
requests for services
TASKS Data Store
performance assessments
personnel actions
performance ratings
work assignments
work schedules
services data
status
PEOPLE Data Store
Employee
FINANCIAL ACCOUNTS Data
Assign Work
qualified employees
task association
DD-PERSONNEL ADMINISTRATION
July 17, 1991 7:38:45




PROGRAMS Data Store
trends/historical info
trends/historical info
technical data
concept revisions
INFORMATION PRODUCTS Data
STRATEGIC PLANS Data Store
guidance/direction
technical data
modifications
unconstrained concepts
options
market analyses
concept specifications
management modifications
goals
effectiveness assessments
financial analyses
management controls
Navy needs
CONCEPTS Data Store
SPONSORS Data Store
SS-CONCEPT DEVELOPMENT
July 17, 1991 7:40:18

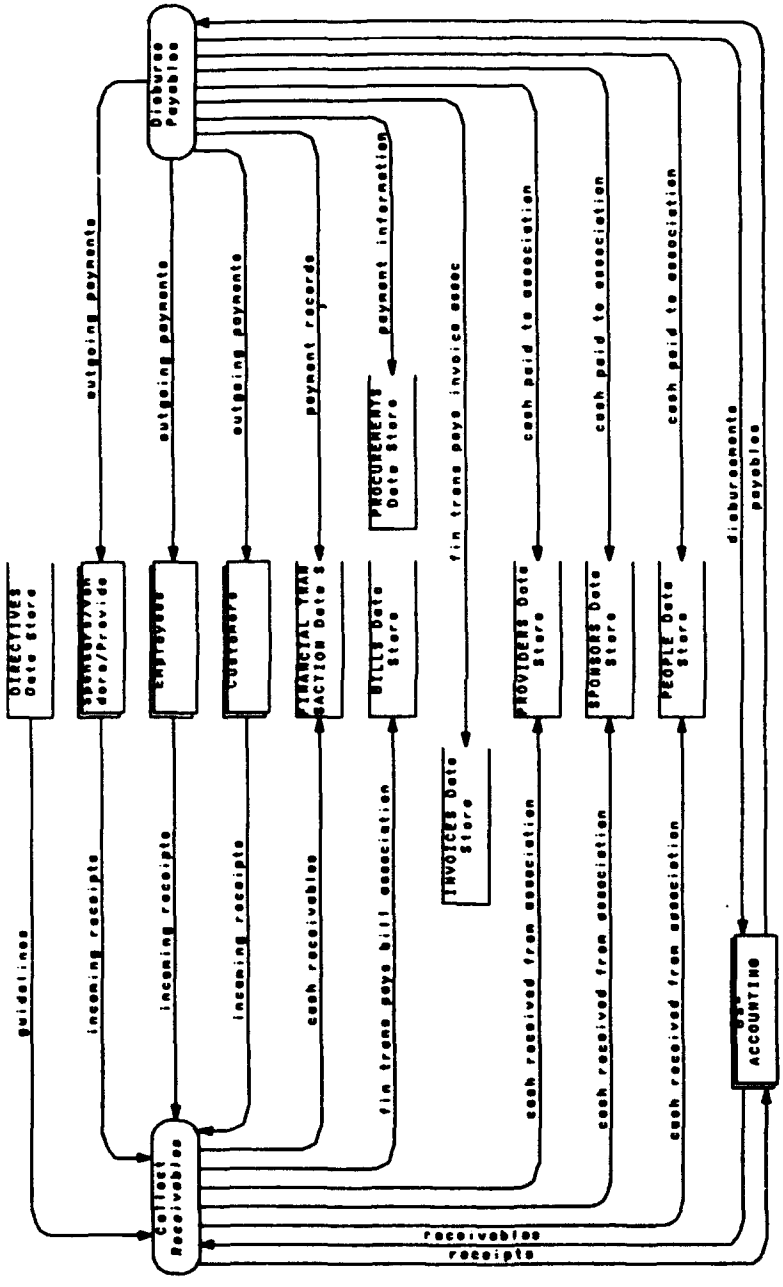

SPONSORS Data Store
DIRECTIVES Data Store
guidelines
proposal association
sponsor details
proposals
sponsor
Market Proposal
accepted proposals
guidelines
selected sponsors
proposals
Determine Sponsors
concept revisions
Develop Proposal
market analysis
knowledge, skills, abilities
facility specifications
labor rate values
proposal association
trends/historical info
trends/historical info
proposal specifics
trends/historical info
proposals
authorized proposals
PEOPLE Data Store
FACILITIES Data Store
BUDGETS Data Store
CONCEPTS Data Store
PROVIDERS Data Store
PROGRAMS Data Store
PROPOSALS Data Store
BS-MARKETING
July 17, 1991 7:40:54

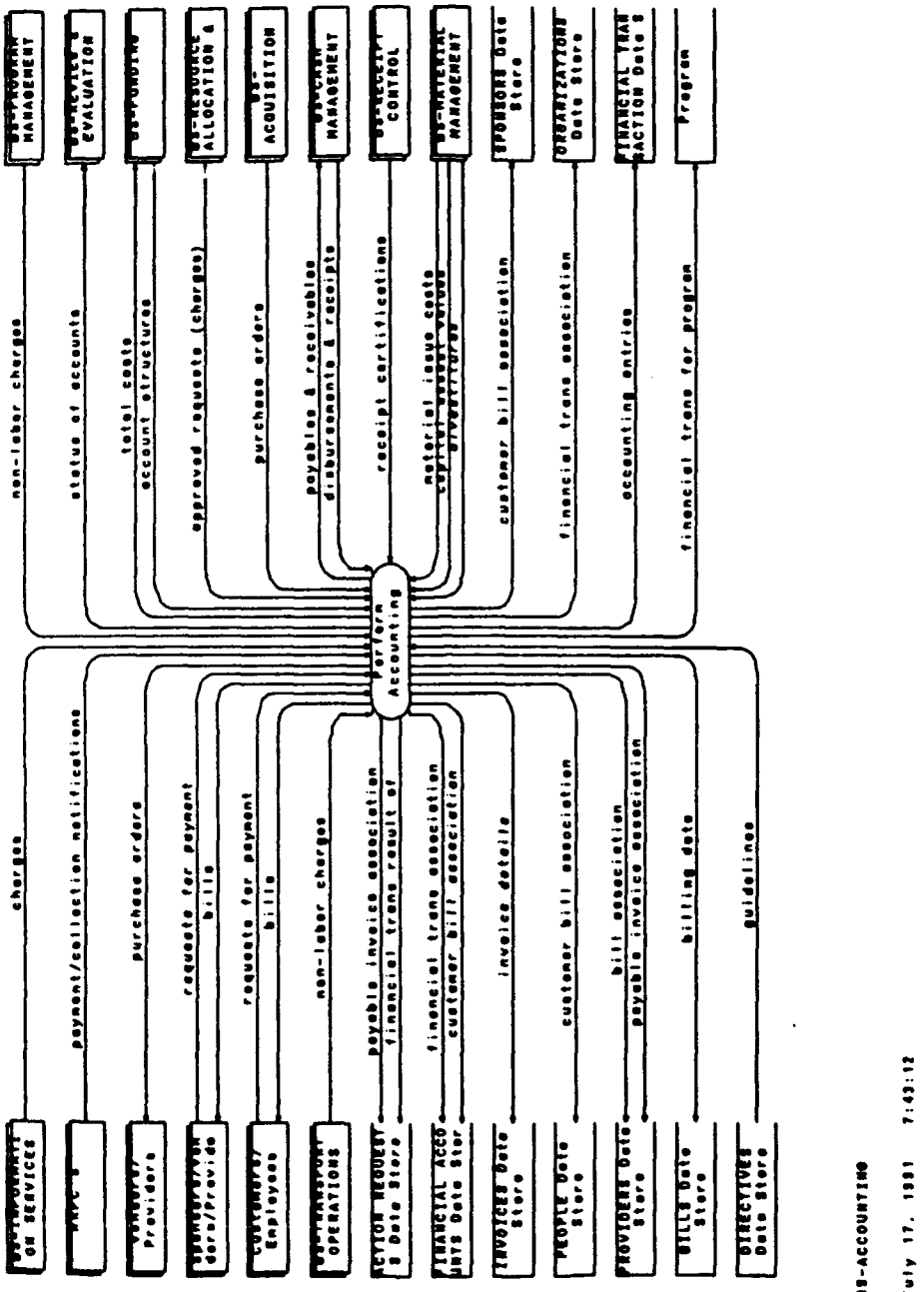

DIRECTIVES Data Store
RAYBUC DEL IVERABLES
INFORMATIO N PRODUCTS
OPERATION SER
product & service info
program association
technical data
non-labor charges
program status
material characteristics
guidelines
plans
Execute Program
PLANNING
planned programs
active programs
guidance/direction
STRATEGIC PLANS Data
operational plans
approved requests & tasks
task specific
Create Program
PLANS Data Store
accepted proposals
tasking
new programs
active programs
program association
program association
PROGRAMS Data Store
PROPOSALS Data Store
MARKETING
guidelines
task specific
PROGRAM MANAGEMENT
July 17, 1991 7:41:27

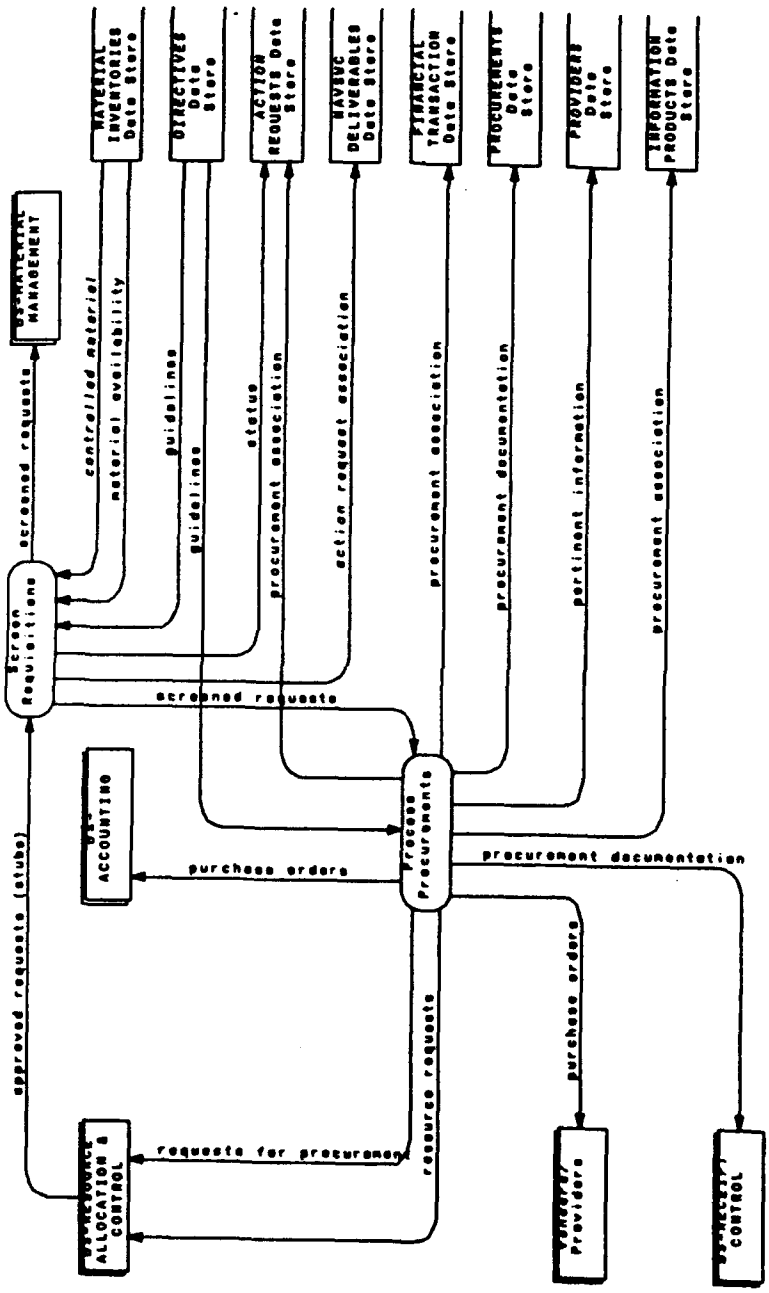


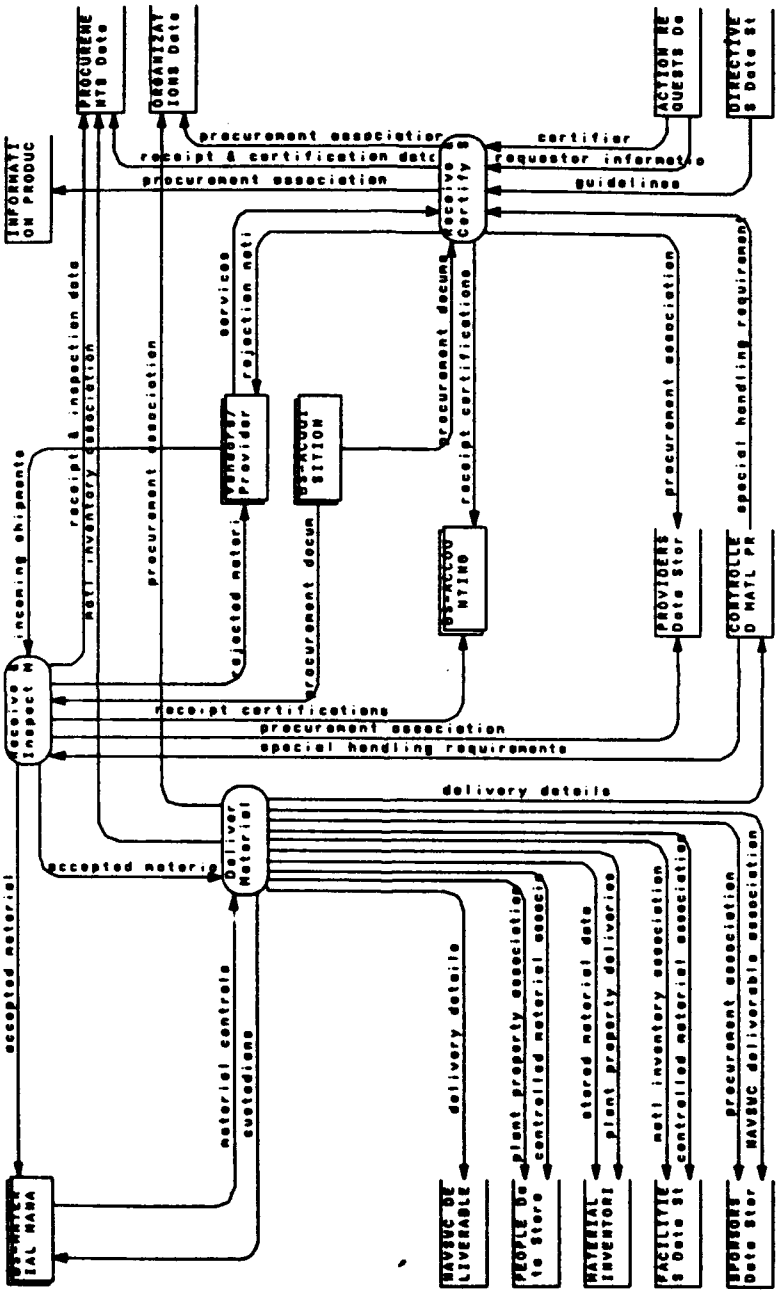
BS-FUNDING

July 17, 1991 7:41:57


Disburse Payables
outgoing payments
outgoing payments
outgoing payments
payment records
payment information
fin trans pays invoice assoc
cash paid to association
cash paid to association
cash paid to association
disbursements payables
DIRECTIVES Data Store
Employees
CUSTOMERS
FINANCIAL TRANSACTION Data S
BILLS Data Store
PROCUREMENTS Data Store
INVOICES Data Store
PROVIDERS Data Store
SPONSORS Data Store
PEOPLE Data Store
ACCOUNTING
guidelines
incoming receipts
incoming receipts
incoming receipts
cash receivables
fin trans pays bill association
cash received from association
cash received from association
cash received from association
receivables
receipts
Collect Receivables
BB-CASH MANAGEMENT
July 17, 1991 7:42:28

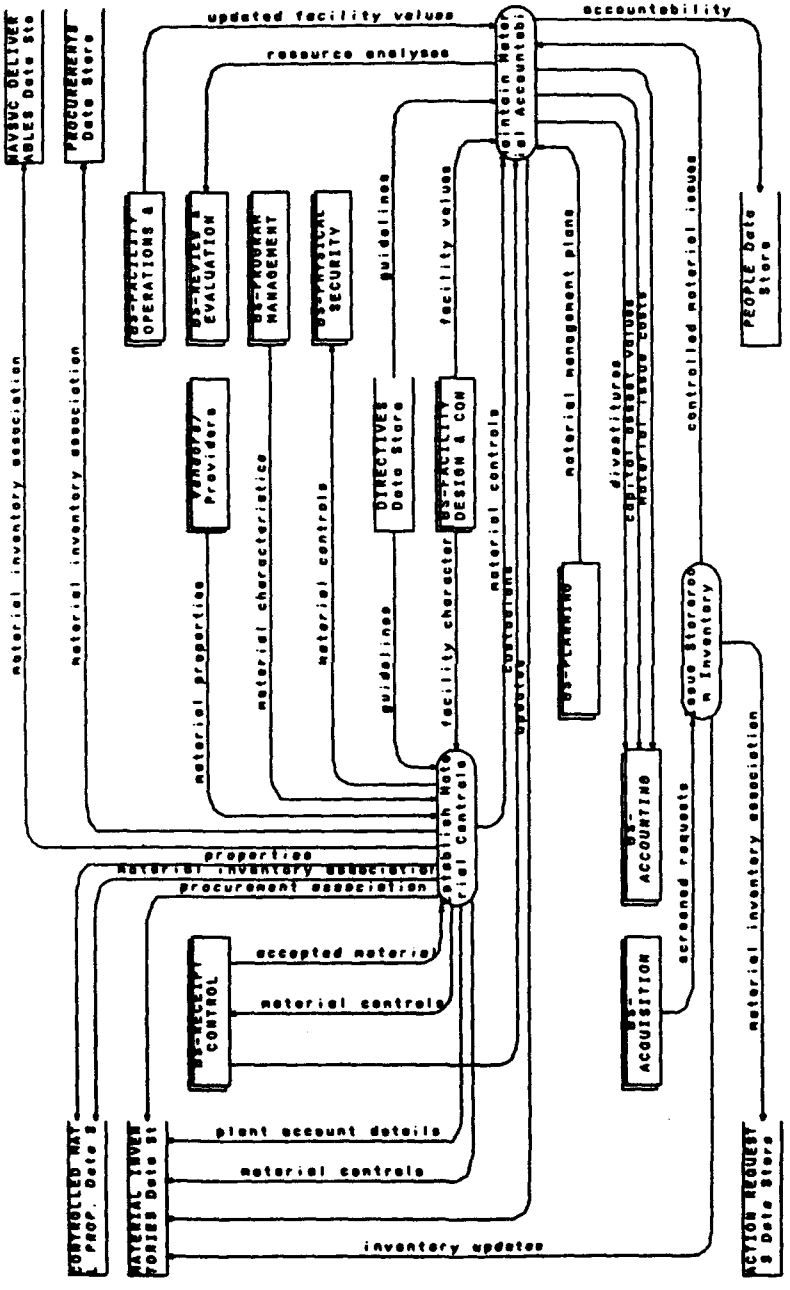

non-labor charges
status of accounts
total costs
account structures
approved requests (charges)
purchase orders
payables & receivables
disbursements & receipts
receipt certifications
material issue costs
customer bill association
financial trans association
accounting entries
financial trans for program
charges
payment/collection notifications
purchase orders
requests for payment
bills
requests for payment
bills
non-labor charges
payable invoice association
financial trans result of
financial trans association
customer bill association
invoice details
customer bill association
bill association
payable invoice association
billing data
guidelines
Perform Accounting
INVOICES Data Store
PEOPLE Data Store
PROVIDERS Data Store
BILLS Data Store
DIRECTIVES Data Store
Program
D0--ACCOUNTING
July 17, 1991 7:43:12


MATERIAL INVENTORIES Data Store
DIRECTIVES Data Store
ACTION REQUESTS Data Store
NAVSVC DELIVERABLES Data Store
FINANCIAL TRANSACTION Data Store
PROCUREMENTS Data Store
PROVIDERS Data Store
INFORMATION PRODUCTS Data Store
MATERIAL MANAGEMENT
Screen Requisitions
ACCOUNTING
Process Procurements
RESOURCE ALLOCATION & CONTROL
screened requests
controlled material
material availability
guidelines
status
procurement association
action request association
procurement documentation
pertinent information
purchase orders
procurement documentation
approved requests (stubs)
requests for procurement
resource requests
purchase orders
BS-ACQUISITION
July 17, 1991 7:44:01



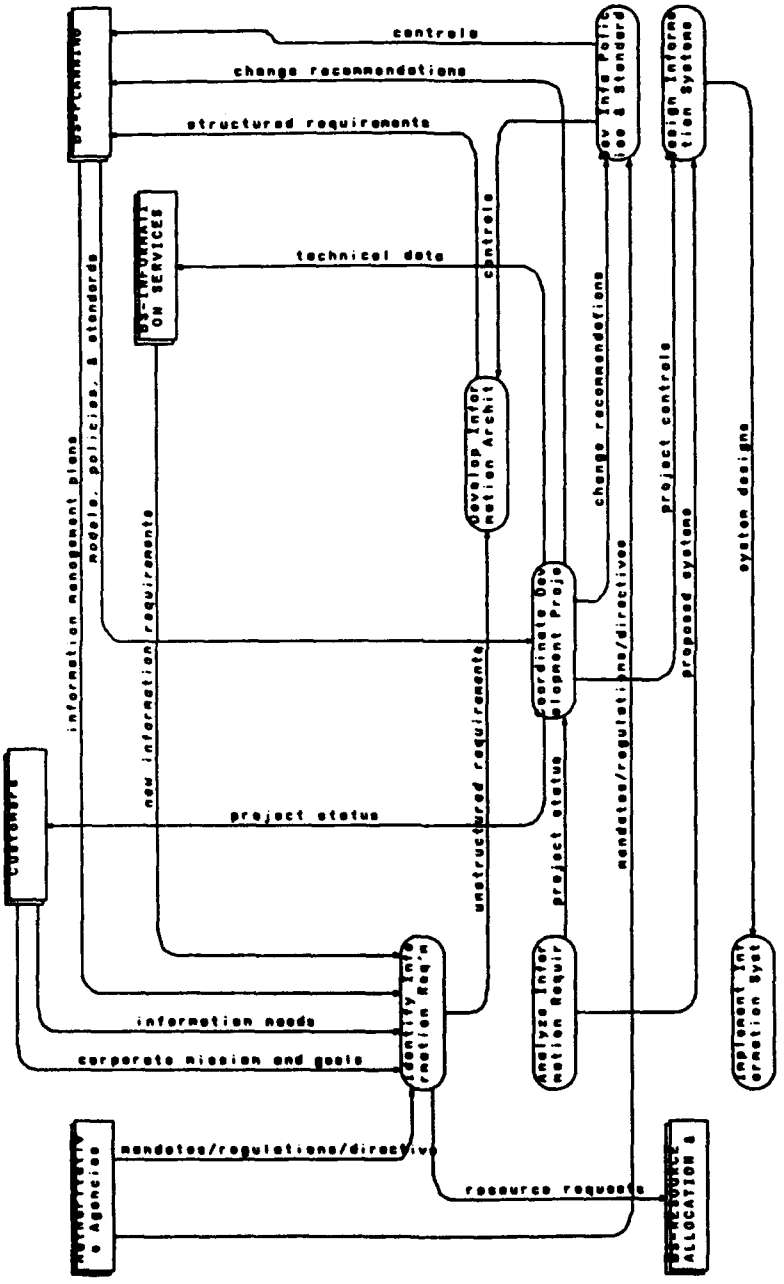
BS-RECEIPT CONTROL

July 17, 1991 7:44:50



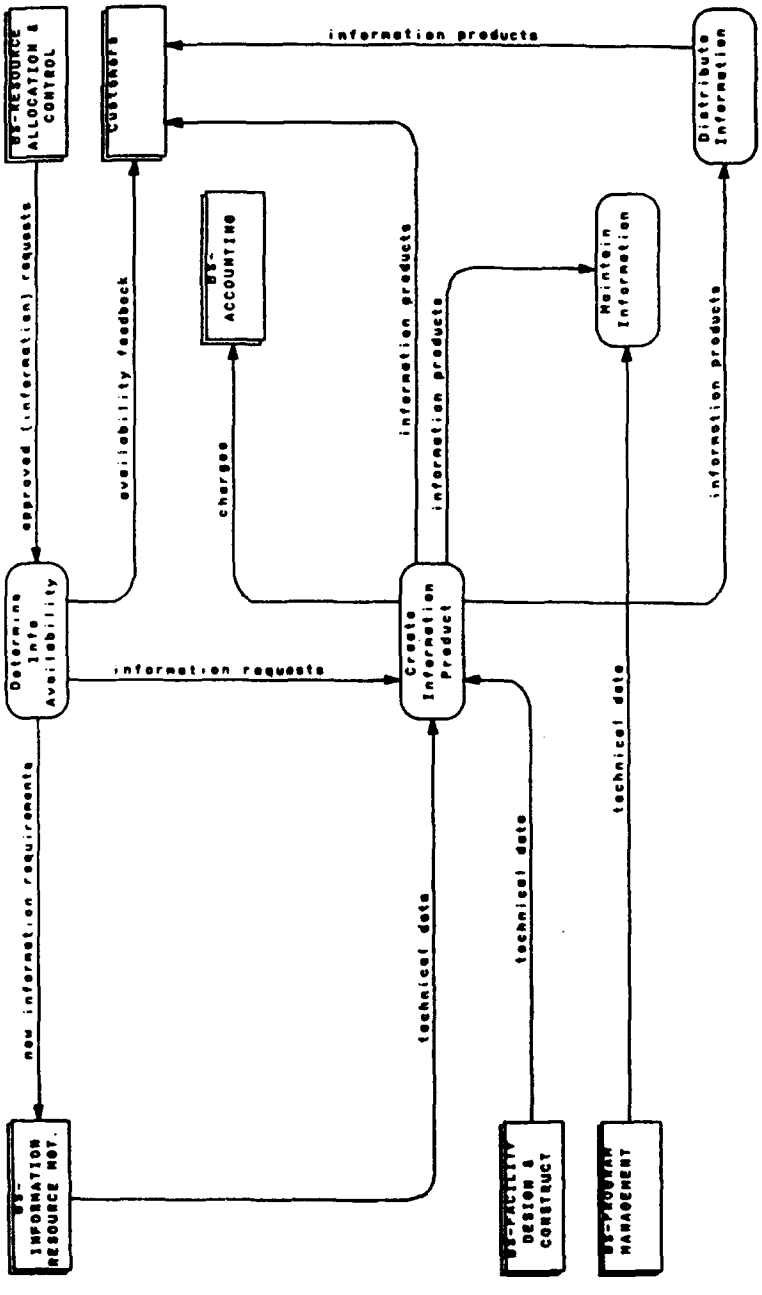
DS-MATERIAL MANAGEMENT

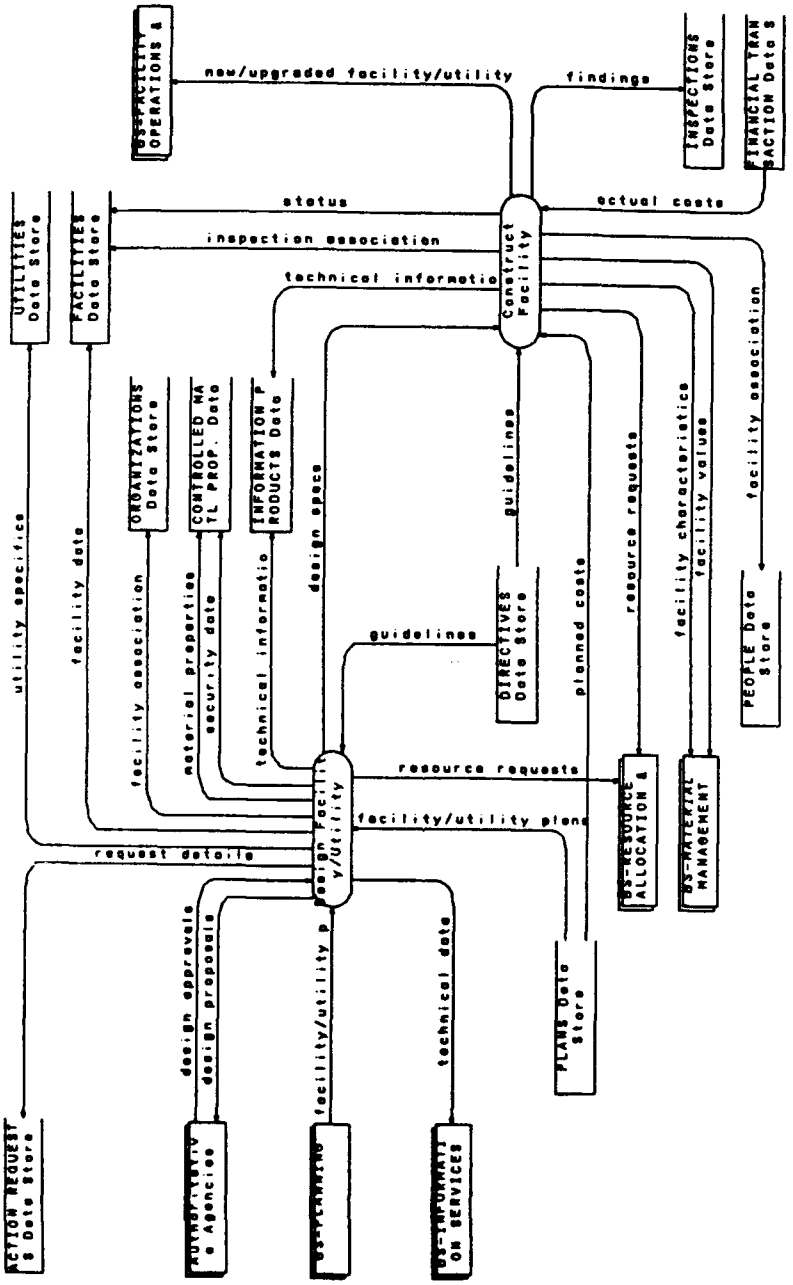
July 17, 1991 7:45:30

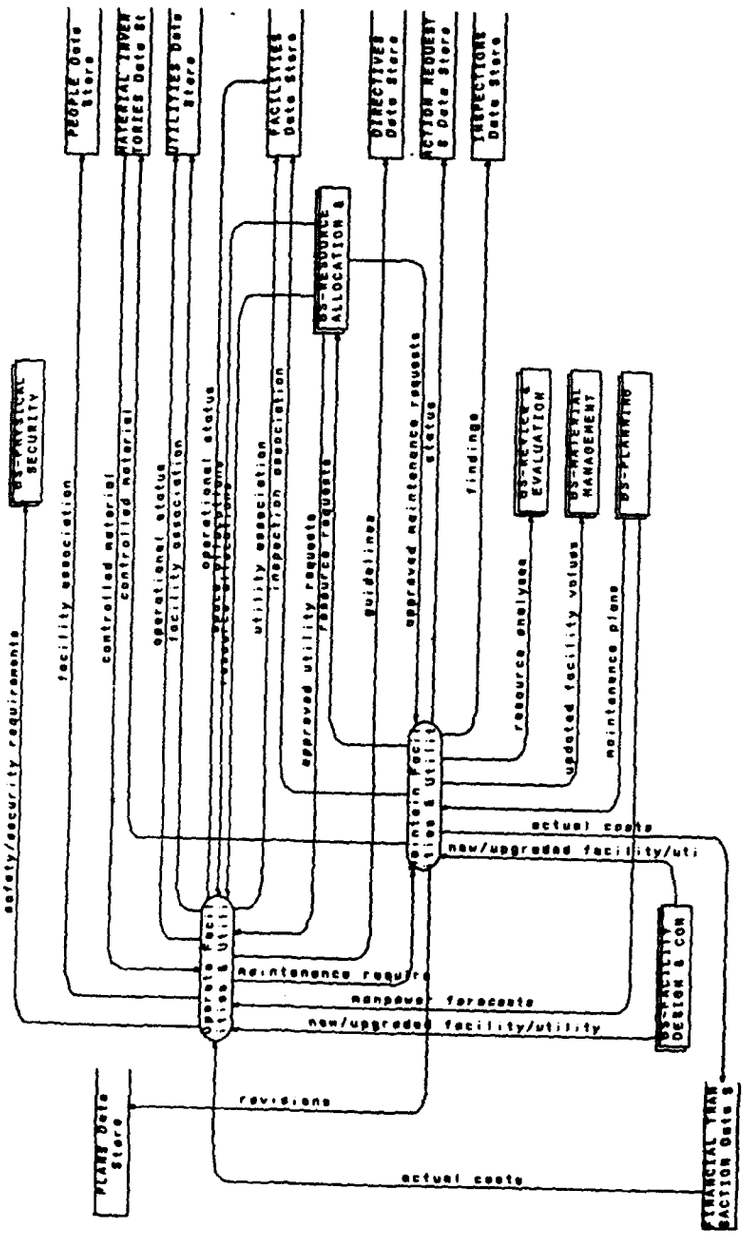


SS-INFORMATION RESOURCE MANAGEMENT

July 17, 1991 7:48:10

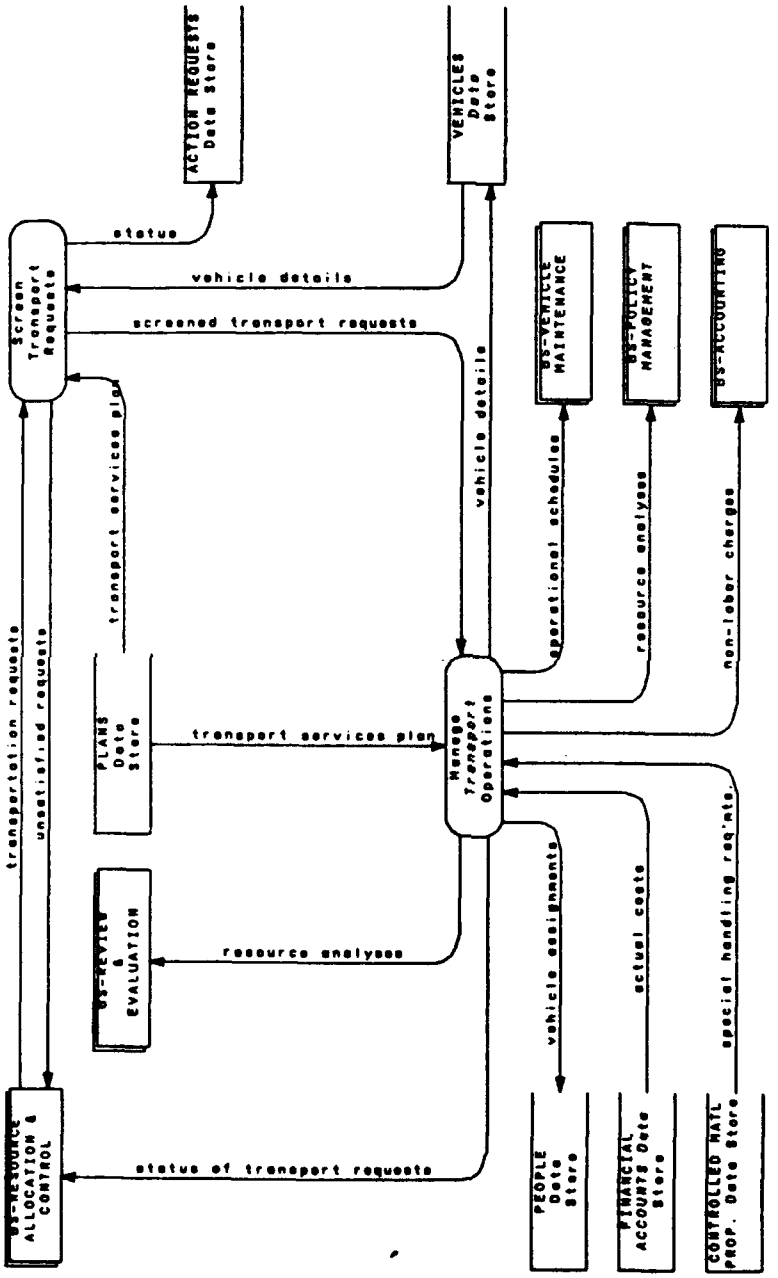

BS-RESOURCE ALLOCATION & CONTROL
CUSTOMERS
Distribute Information
BS-ACCOUNTING
Maintain Information
Determine Info Availability
Create Information Product
BS-INFORMATION RESOURCE MGT.
BS-FACILITY DESIGN & CONSTRUCT
BS-PROGRAM MANAGEMENT
information products
approved (information) requests
availability feedback
charges
information products
information products
information products
information requests
new information requirements
technical data
technical data
technical data
BS-INFORMATION SERVICES
July 17, 1991 7:46:47


new/upgraded facility/utility
findings
status
actual costs
inspection association
technical information
guidelines
resource requests
facility characteristics
facility value
facility association
utility specifics
facility data
material properties
security data
technical information
design space
planned costs
facility/utility plans
request details
design approvals
design proposals
technical data
facility/utility p
Design Facility/Utility
Construct Facility
UTILITIES Data Store
FACILITIES Data Store
ORGANIZATIONS Data Store
CONTROLLED MA TL PROP. Data
INFORMATION P RODUCTS Data
DIRECTIVES Data Store
PEOPLE Data Store
PLANS Data Store
INSPECTIONS Data Store
FINANCIAL TRAN SACTION Data S
ACTION REQUEST S Data Store
DS-RESOURCE ALLOCATION &
DS-MATERIAL MANAGEMENT
DS-INFORMATI ON SERVICES
DS-FACILITY DESIGN & CONSTRUCT
July 17, 1991 7:47:17



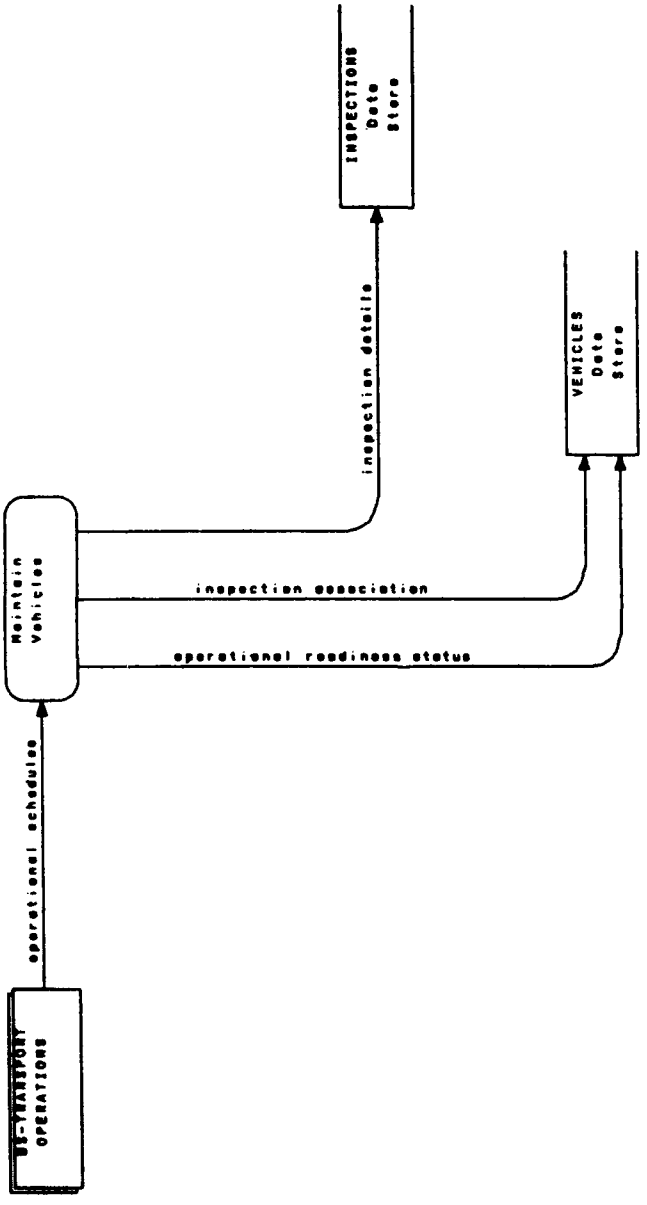
DS-FACILITY OPERATE & MAINTAIN

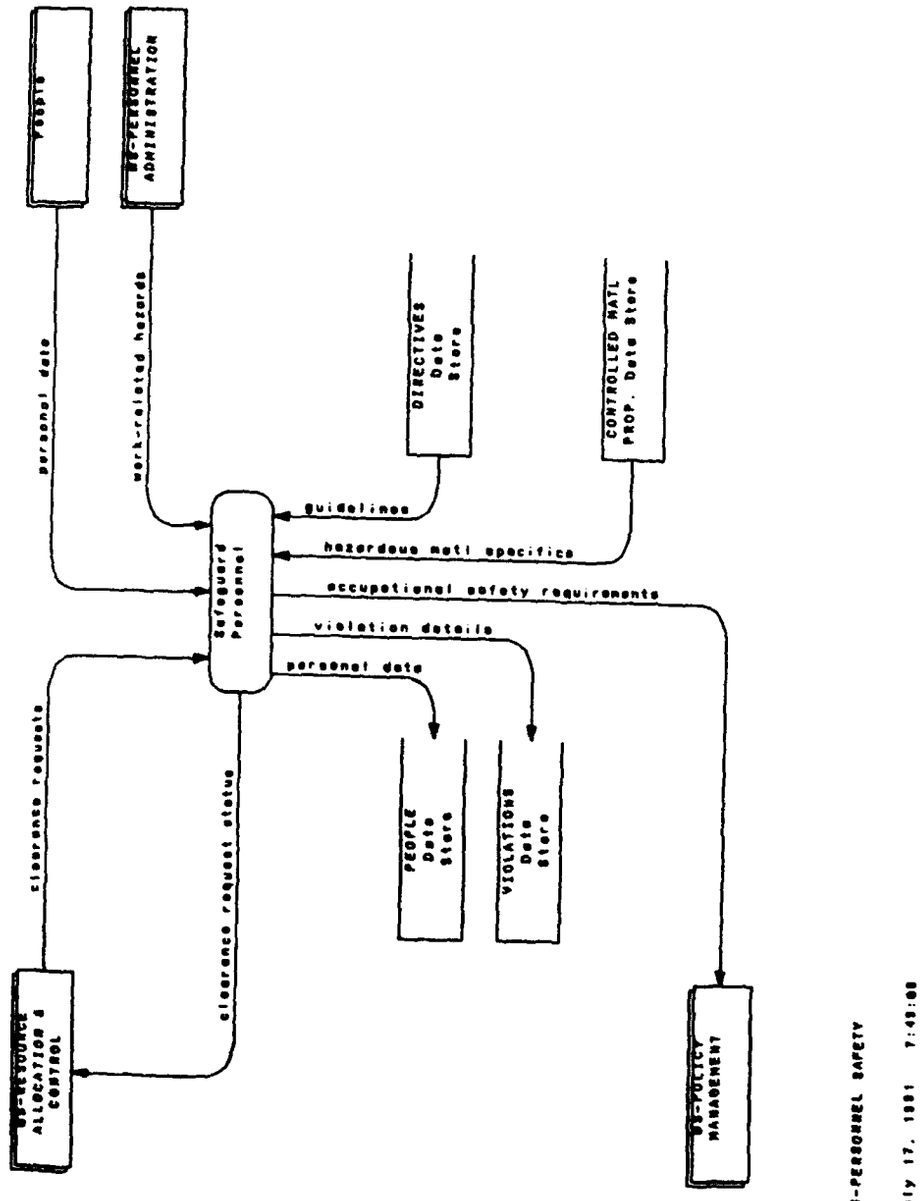
July 17, 1991 7:47:48

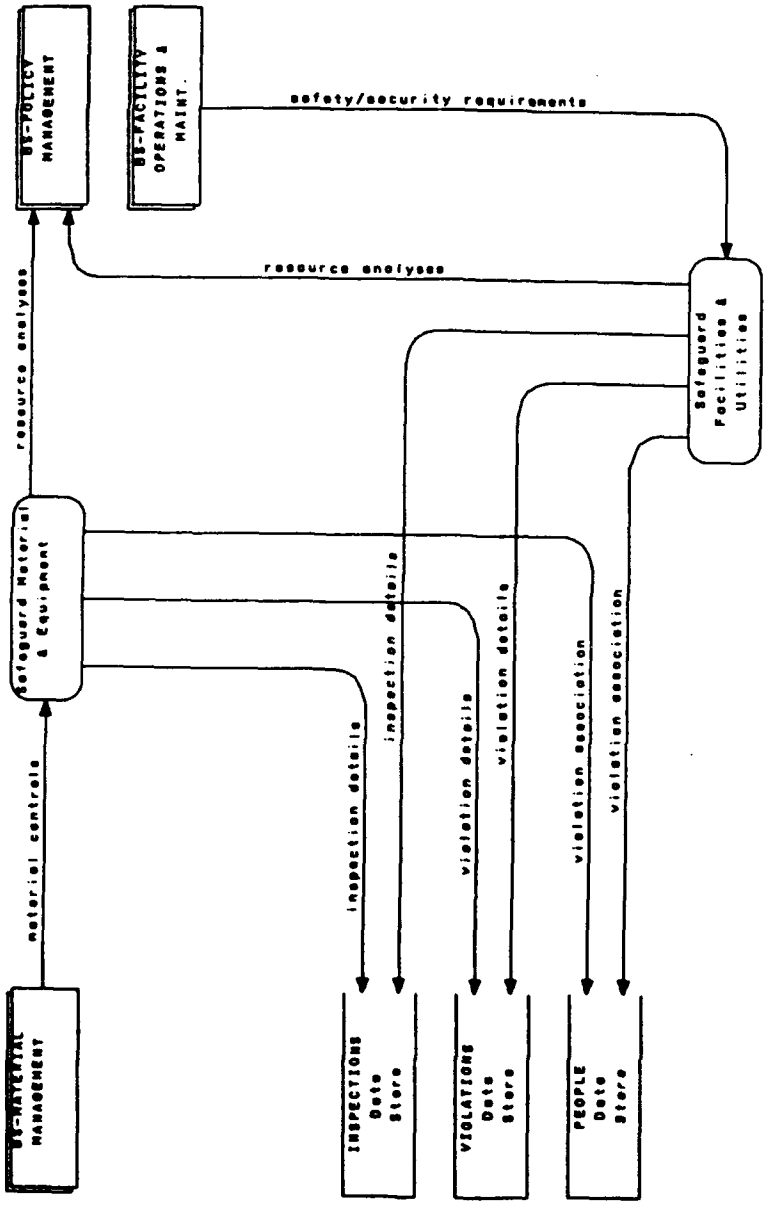


BS-TRANSPORT OPERATIONS

July 17, 1991 7:48:14


INSPECTIONS
Data
Store
VEHICLES
Data
Store
inspection details
Maintain
Vehicles
inspection association
operational readiness status
operational schedules
US-TRANSPORT
OPERATIONS
D8-VEHICLE MAINTENANCE
July 17, 1991 7:40:38


personal data
work-related hazards
DIRECTIVES Data Store
CONTROLLED MATL PROP. Data Store
guidelines
hazardous matl specifics
occupational safety requirements
violation details
personal data
Safeguard Personnel
clearance requests
clearance request status
PEOPLE Data Store
VIOLATIONS Data Store
SS-POLICY MANAGEMENT
SS-PERSONNEL SAFETY
July 17, 1991 7:49:08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INSPECTIONS Data Store
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BS-PHYSICAL SECURITY
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APPENDIX E

INFORMATION NEEDS SOURCE DOCUMENTS LIST

Engineering Department Business Information Requirements (NSWC MP 88-205), Volume I, July 1988

Draft System Specification for the Electronics Systems Department Information Resource Management System (FIRMS), April 1987

K30 Requirements Listing

NSWC Office Automation (NOA) Requirements Document

Information Resource Management Phase II Report (NSWC MP 86-193), October 1986

Functional Requirements for Business Information System - Preliminary Report, April 1989

Strategic Plan for Managing Business Information, February 1989

Memorandum dated 4 November 1988, from U to E, Subject: SLBM Software Engineering Environment Requirements

PEP User Survey

A STRATEGIC PERSPECTIVE ON THE FUTURE OF THE NAVAL SURFACE WARFARE CENTER

Memorandum from U30-AMJ dated 28 June 1989, Subject: CORPORATE WELLNESS INDICATORS.

Memorandum from D213-CLB, 5200, dated 3 December 1990, Subject: CORPORATE TREND INDICATORS.

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